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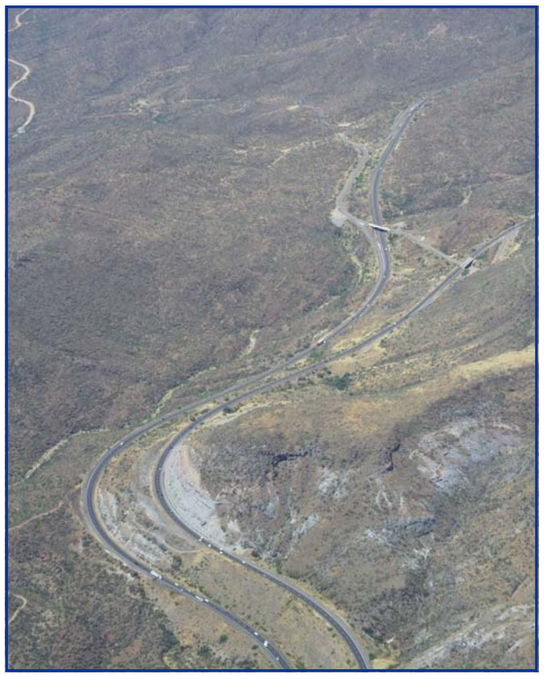

ALTERNATIVE SELECTION REPORT

I-17, New River Traffic Interchange to Jct. SR 69 (Cordes Junction)

MP 232 – 262

ADOT Project No. 17 MA 232 H6800 01L
Federal Project No. STP-017-A(ARV)

Phoenix – Cordes Junction Highway
Cordes Junction – Flagstaff Highway

JULY 2007

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1.0 Introduction

1.1 Study Overview and Description

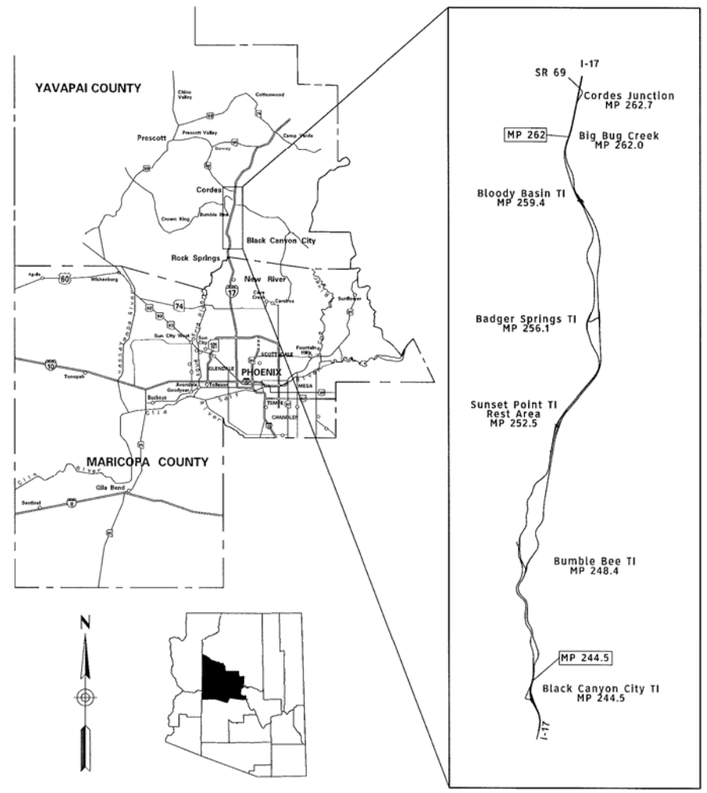
Interstate 17 (I-17) connects Interstate 40 and Interstate 10, two of the nation's principal east-west highways. It is part of a critical north-south trade and truck route linking Mexican markets with Arizona's major urban centers and markets of New Mexico, Utah, and northern California. In addition to accommodating rapidly increasing local traffic, I-17 provides the fastest and most direct route between the central parts of the state, including the Phoenix metropolitan area, and central/northern Arizona, including Prescott, Flagstaff, and recreational and tourist attractions.

The Arizona Department of Transportation (ADOT), in partnership with the Federal Highway Administration, has initiated a design concept study and related environmental studies to evaluate the proposed improvements to I-17 in Maricopa and Yavapai counties, Arizona. The overall study area begins at the I-17/New River Traffic Interchange (TI) at milepost (MP) 232.0 and extends north to the I-17/Junction State Route 69 (SR 69) TI in Cordes Junction at MP 262.0. The engineering studies for the southern part of the overall project were completed with the I-17 Widening Study, SR 101L TI to Black Canyon City TI (Project No. 17 MA 215 H5162 01L); this Alternative Selection Report will address only the section of I-17 from the Black Canyon City TI (MP 244.5) to Jct. SR 69 (MP 262.0) (Figure 1). However, the limits of the environmental study for this project extend from the New River TI (MP 232.0) to Jct. SR 69 (MP 262.0).

Most of the study route is located adjacent to land that is administered by the Bureau of Land Management (BLM), including the Agua Fria National Monument (AFNM) abutting the eastern ADOT right-of-way between MP 245.0 and MP 260.3. The BLM also owns the land west of I-17 for most of the project length, as well as parts of the median area between northbound and southbound I-17. The Arizona State Land Department administers the remaining adjacent land, with the exception of several small privately-owned parcels.

The existing roadway is a four-lane divided rural highway with full access control. The roadway traverses mountainous to rolling terrain. The mountainous terrain extends from approximately MP 244.5 to MP 250.5. The existing I-17 horizontal and vertical alignments in this mountainous terrain present challenges related to steep grades and horizontal curves with limited sight distance. In addition, accidents in the southern half of the study area cause closures of I-17 that can result in lengthy travel delays along the route. There are currently no viable alternate detour options in this area The remaining segments of the existing northbound and southbound alignments are located within rolling terrain from MP 250.5 to MP 262.0. This range corresponds to Sunset Point to Cordes Junction, the north end of the study area.

Figure 1 – Vicinity Map



1.2 Project Purpose

The purpose of this project is to add capacity to and improve operations of I-17 from the New River Road TI to Cordes Junction. The study will develop and evaluate feasible alternatives for the ultimate widening of I-17, as well as interim (short-term) improvements, to improve traffic operations and to accommodate projected traffic volumes in the 2030 design year. The results of the engineering analysis will be fully documented in a Design Concept Report (DCR). The environmental analyses will be presented in an environmental document prepared in conformance with the requirements of the National Environmental Policy Act (NEPA).

1.3 Scoping Process

ADOT initiated the I-17 design concept study by conducting scoping meetings with federal, state, county, and local agency representatives and the general public. The agency and public scoping meetings for the project were held on July 13, 2006, in Spring Valley, Arizona. The purpose of these meetings was to provide a general overview of the study area and to obtain information from the agency representatives, business people, and area residents about the existing roadway and surrounding area to identify the issues, concerns, and opportunities (ICOs) that should be addressed by the evaluation criteria for use during the development and analysis of alternatives in the DCR and environmental document. The following ICOs were identified during the meetings and subsequent comment periods.

1.3.1 Design Issues, Concerns, and Opportunities

The safe flow of traffic through the corridor is a major concern for both the public agencies and the general public. The opinions expressed during the meetings indicated a strong desire for a bypass route that could be used by motorists to avoid incidents that currently result in lengthy closures of I-17 between Black Canyon City and Cordes Junction. Design ICOs identified through the scoping process included:

- Need for an alternate route, or frontage roads in specific areas, for vehicle use when I-17 is closed due to accidents
- Incorporation of Freeway Management System message signs to alert motorists about traffic congestion, accidents, and inclement weather
- Expansion to four travel lanes in each direction
- Elimination of the Sunset Point Rest Area and replacement with a developer-financed truck stop in Black Canyon City or Cordes Junction
- Provide additional parking at the Sunset Point Rest Area and/or a new northbound rest area to relieve congestion
- Fencing the existing R/W in appropriate locations to funnel wildlife to desired crossing locations
- Flatten curves along I-17 to improve drivers' visibility and opportunities to avoid chain reaction accidents and vehicle/wildlife conflicts
- Create buffers between public use areas along I-17 and potential wildlife areas for fire protection because wild fires are often started by roadside vehicles
- Easterly alignment shifts of the northbound lanes should be restricted to remain within the existing R/W
- Maintain access for Arizona Game & Fish Department (AGFD) maintenance crews and water trucks to existing water catchments (e.g., southwest of the Badger Springs TI and east of the Bumble Bee TI) that are used by wildlife along I-17
- Provide bat structures under the bridges
- The development of alternatives should account for existing and new (e.g., Transwestern) natural gas pipelines adjacent to I-17
- The development of alternatives should account for incident management and emergency response routes
- Truck climbing lanes are essential on the Black Canyon grade
- A dedicated truck-only lane should be provided in both directions on the Black Canyon grade

- If new alignments are going to be considered, abandoned road segments should be retained and used for incident management
- Bridge design accounting for flood flows that are resistant to being washed out
- Potential impacts to existing and planned natural gas pipelines
- Maintenance of traffic during construction
- Traffic projections should account for current statistics and population growth factors
- Park-and-ride facilities should be considered in Black Canyon City
- Light rail should be considered to connect Prescott and Phoenix to reduce traffic volumes and congestion on I-17
- Truck runaway/safety ramps are needed on the southbound descent
- Safety pullouts and/or wider shoulders are needed for disabled vehicle and emergency vehicle use
- Speed restrictions for southbound trucks on Black Canyon downgrades should be considered
- Median crossovers to connect the northbound and southbound lanes should be installed, where appropriate, to aid in rerouting traffic when lanes are blocked during construction, accidents, or wildfires.
- Widen the shoulders to provide opportunities to bypass accidents or other blockages

1.3.2 Social and Economic ICOs

- Unreliability of I-17 regarding unpredictable travel time due to heavy traffic, freeway closures due to accidents, and the added travel costs (i.e., people now travel the night before to reach destinations)
- Access across I-17 must be maintained in Black Canyon City for emergency services during construction
- Coordinate with the Yavapai County Trails Committee concerning existing trail locations
- Stop uncontrolled access to sensitive areas
- Black Mesa is a tourist attraction area for hiking, but there are problems with parking and litter.
- Future land use in the project area, as defined in the Statewide Area Master Plan, should be considered as alternatives are developed for handling future traffic volumes to ensure maximum build-out is addressed
- I-17 is the lifeline to northern Arizona and should be widened as soon as possible
- Adverse impacts to the community of Black Canyon City (school, noise, and a gated senior neighborhood)
- Project cost
- Potential project impact on local property values
- Expansion of I-17 will promote growth along the corridor
- Project information should be made available at the Black Canyon City Chamber of Commerce to keep concerned citizens informed of the study's progress

1.3.3 Environmental ICOs

- Impacts to waters of the US should be avoided to the extent possible
- The existing nationwide permits will expire in 2007
- Environmental impacts of this project, particularly the natural and cultural resources in the AFNM located immediately east of I-17, should be minimized to the greatest extent possible
- Maintain the existing AFNM boundary
- The permeability of the highway ROW fences (e.g., pronghorn passable fences) should be increased
- I-17 improvements should provide for habitat connectivity by maintaining existing wildlife crossings and improving opportunities for wildlife
- Provision of a landscaped buffer in the median or leaving the median as it is
- Avoiding tree removal
- Geologic instability and seismic activity
- Assessing and avoiding impacts to federally listed threatened, endangered and candidate species, state sensitive species, and native plants
- Habitat disturbance and losses should be minimized
- Alternatives should not encroach into wildlife movement corridors located east of I-17 (e.g., for pronghorn near the Sunset Point and Badger Springs TIs).
- Provide places for motorists to dump trash at the Sunset Point and Badger Springs TIs because litter is a serious problem
- Bat structures should be provided under bridges along the corridor
- The Agua Fria watershed is very fragile, particularly due to a 10-year drought. ADOT needs to reduce or eliminate its removal of Agua Fria water for the Sunset Point Rest Area as well as ensure that no additional water is tapped for widening I-17.
- Move I-17 off Black Mesa and use overpasses on new alignments to facilitate and restore pronghorn migration through the area.
- Wildfires are occurring too frequently on Black Mesa; ADOT and BLM should work collaboratively to ensure fires do not impair AFNM resources.
- Visual impacts to this scenic stretch of interstate highway should be minimized
- Impacts associated with the Sunset Point Rest Area on wildlife habitat/migration, noise, litter and other pollutants, and the water quality and quantity of the Agua Fria watershed should be evaluated.
- Improvements to I-17 will result in increased visitation to the AFNM, which will have cumulative impacts to AFNM resources that will need to be addressed.
- Close coordination with BLM throughout the study process is required.

2.0 Existing Conditions

2.1 Roadway Characteristics

The southern limit of the engineering portion of the study is the I-17/Black Canyon City TI. North of the interchange, I-17 is a four-lane divided highway constructed on mountainous terrain with a posted speed of 65 miles per hour (mph). Once the highway reaches the top of Black Mesa south of Sunset Point, the terrain changes to rolling and the posted speed increases to 75 mph (MP 250.5).

Mainline lanes average 12 feet in width, with 10-foot outside shoulders and 4-foot inside shoulders. The existing highway cross slope is 1.5% in tangent sections from approximately MP 244.5 to MP 262.0. The southbound roadway was the original two-way highway and was constructed with a parabolic crown rather than a straight left-to-right cross slope. Median widths within the study limits vary from 64 feet to more than 1800 feet.

There are no existing frontage roads in the study area.

Traffic interchanges and significant features exist at the following approximate locations:

Table 1 – Roadway Characteristics

I-17 CROSSING	MP	COMMENTS
Black Canyon City TI	244.4	Southern study limit - Diamond Interchange
Bumble Bee TI	248.4	Diamond Interchange - Wide median
Sunset Point TI / Rest Area	252.5	Rest area in southwest quadrant - Diamond Interchange – Compact
Badger Springs TI	256.1	Diamond Interchange – Wide median
Bloody Basin TI	259.4	Diamond Interchange
Big Bug Creek	262.0	Northern study limit
SR 69 / Cordes Jct TI	262.7	TI reconstruction design underway by others

The existing northbound and southbound I-17 horizontal alignments consist of numerous curves with degrees of curvature ranging from 0º 30' to 4º 00'. The alignments negotiate the rough terrain up to the top of Black Mesa by means of winding curves cutting back into the mountainside, limiting the available sight distance around some cut locations. Once at the top of Black Mesa, horizontal alignments are much straighter, with a maximum degree of curvature of 2º 00". There are several curves in which the superelevation does not meet current standards; this occurs more often in the southbound direction, the original State Route 69 alignment.

In the mountainous section of the roadway (MP 244.5 to MP 250.5), the existing grades average +3.9% and range from +0.4% to +6.0% in the northbound direction and from -1.7% to -6.3% in the southbound direction. In the rolling terrain section (MP 250.5 to MP 260.0), existing grades average +0.7% and range from +4.8% to +5.0% in the northbound direction and from -4.5% to -5.2% in the southbound direction

2.2 Land Use

The land adjacent to I-17 through the project area is mostly undeveloped. On the east side of I-17 from Black Canyon City to south of Cordes Junction is the AFNM, which is administered by the Bureau of Land Management. BLM also administers the land on the west side of I-17 and in several wide median areas between the existing northbound and southbound I-17 alignments.

Small areas of State land and private land exist near Black Canyon City and near Cordes Junction. Scattered residential development exists in both areas.

2.3 Utilities

The major existing utilities for the I-17 corridor are presented in Table 2.

Table 2 – Existing Utilities

UTILITY TYPE	LOCATION
AT&T Fiber Optic	
Fiber Optic (1 ¼ " inner duct)	West of Black Canyon City TI (MP 244.5) follows old Route 69 alignment (Maggie Mine Road) paralleling I-17
Fiber Optic (1 ¼ " inner duct)	Follows old Route 69 alignment (Crown King Road) paralleling I-17 from the Bumble Bee TI (MP 248.4) to the Badger Springs TI (MP 256.1)
Fiber Optic (1 ¼ " inner duct)	Follows old Route 69 alignment (Crown King Road) in the north west direction to Cordes
Arizona Public Service	
Overhead Power	West of Black Canyon City TI (MP 244.5) follows old Route 69 alignment (Maggie Mine Road) paralleling I-17
Overhead Power	Crosses I-17 at 2431+40 (MP 247.4)
Overhead Power	Continues north east to Radio Tower east of the Bumble Bee TI (MP 248.4)
Western Area Power Administration	
345 kV Transmission Line	West of Black Canyon City TI (MP 244.5) paralleling I-17
345 kV Transmission Line	Crosses southbound (SB) I-17 2356+80 (MP 245.88)
345 kV Transmission Line	Crosses northbound (NB) I-17 2367+62 (MP 246.11)
345 kV Transmission Line	Paralleling East of I-17 within the Agua Fria National Monument
345 kV Transmission Line	Crosses NB I-17 2950+02 (MP 257.20)
345 kV Transmission Line	Crosses SB I-17 2998+04 (MP 258.11)
There are numerous transmission towers supporting overhead (OH) lines throughout the project limits.	
El Paso Natural Gas	
20" Gas Pipeline	West of Black Canyon City TI (MP 244.5) paralleling I-17
20" Gas Pipeline	Crosses I-17 at 2431+40 (MP 247.4)
20" Gas Pipeline	Crosses I-17 NB at 2920+90 (MP 256.65)
20" Gas Pipeline	Crosses I-17 SB at 2929+24 (MP 256.81)
Eagle West Cable	
Cable	Aerial crossing over I-17 at Mud Springs
Transwestern Pipeline Company	
42" Gas Pipeline	Proposed alignment TBD

There are no railroad crossings in the study area.

There is existing lighting at the Sunset Point TI/Rest Area. A Variable Message Sign (VMS) is located just south of the Sunset Point TI/Rest Area in the northbound direction at Sta 2678+06 (MP 251.91).

2.4 Traffic

Stanley Consultants has prepared a preliminary traffic report to present existing traffic volume data, existing crash data, traffic volume projections for the design year 2030, and design year roadway capacity calculations.

2.4.1 Traffic Characteristics

Traffic volumes for the study section of I-17 and for sections north and south of the study area were provided by ADOT Transportation Planning Division. The following table shows the two-way average daily traffic volumes at three locations in the project vicinity.

Table 3 – I-17 Mainline 2005 Ave. Daily Traffic Volumes

LOCATION ON I-17 MAINLINE	TWO-WAY ADT
South of Black Canyon City	36,900
Black Canyon City to Cordes Jct.	29,100
North of Cordes Jct.	19,000

Source: ADOT Transportation Planning (March 2007)

The peak hour traffic on I-17 fluctuates widely in the study area depending on day of week and time of year. This section of I-17 serves a mix of traffic that can be described as rural/recreational traffic. The most current and available year-long traffic data applicable to this study section are reflected in the 2005 volumes from the ADOT automatic traffic recorder (ATR) located on I-17 at New River Road, near MP 232. Eleven months of data are available from this ATR. The ATR hourly volumes were analyzed to characterize the rural/recreational

traffic conditions. The rural/recreational traffic has a unique traffic characteristic, where the weekend peak hour traffic exceeds weekday peak hour. This characteristic is significantly different than the typical urban weekday morning and late afternoon work-home commuting peak hour of traffic. In addition to the weekend peak hour of traffic, the rural/recreational traffic is typically subject to seasonal volume variations. For example, the summer season generally has more recreational trips. The rural segments of I-17 have many of the highest hourly volumes occurring on popular travel holidays such as Memorial Day and Labor Day.

To characterize the weekly traffic in the study segment, the average day of the week volumes were calculated to show the variation of traffic for an average week of the year. The annual average of the specific day of the week was taken for all seven days of the week. Saturday and Sunday have significantly higher volumes when compared to the Monday through Thursday traffic. The variations in the daily volumes consistently indicate that the weekend traffic is approximately 30 percent higher than the average weekday traffic.

The analysis results in the following factors:

- 2005 DHV (Design Hourly Volume) = 3,892 vehicles per hour (vph)
- K (30^{th} Highest Hour) = 10.6%
- D (Average of 21^{st} – 30^{th} Highest Hours) = 58.8%

Based on this analysis, the resulting 2005 Directional Design Hourly Volume (DDHV) at the New River ATR would be 2288 vph.

The recreational/rural traffic has exhibited highly directional characteristics at times. Severe directional peaking, with a 75/25 directional split, could result in extremely high volumes in one direction and very low volumes in the other direction. When evaluated together, these two volumes may not result in a two-way total that would fall within the 30^{th} highest hour for two-way traffic, but could represent a controlling directional design hourly volume. To adequately consider this consequence, a similar analysis was performed using strictly directional volumes from the New River ATR site. The 200^{th} highest hours of northbound and southbound traffic in 2005 were analyzed using the data from the New River Road ATR.

The directional volume analysis indicated the 30^{th} highest hour in the northbound direction is 2,272 vph. This is very close to the DDHV of 2,288 vph derived in the analysis of the two-way volumes. The directional volume for the 30^{th} highest hour in the southbound direction is 2,594 vph, which is approximately 13% greater than the DDHV derived in the analysis of the two-way volumes.

2.4.2 Crash History

Crash data was obtained from ADOT for the I-17 mainline from MP 244 to MP 262. The data covers a five year period from December 4, 2000, to December 3, 2005. On average, there are more crashes in the northbound direction, with approximately 100 crashes per year in the study section. There are approximately 80 crashes per year in the southbound direction. The majority of the crashes in the study section are single vehicle crashes. There are also a large proportion of rear end crashes, particularly in the northbound direction.

The data indicates the southbound roadway tends to have more severe crashes, with a mean of over three fatal crashes per year and over eight incapacitating injury crashes per year. Approximately 70% of the crashes in the northbound direction are property-damage-only type crashes.

The average number of crashes per mile tends to be much higher in the mountainous portions of the study area, between MP 244 and 251. As a result, the manner of collision and severity analyses were refined to focus on this area. On average, there are slightly more crashes in the northbound direction, with approximately 50 crashes per year. There are approximately 40 crashes per year in the southbound direction. Approximately 50% of the crashes in the northbound mountainous section are rear-end crashes. Approximately 75% of the crashes in the southbound mountainous section are single-vehicle crashes.

In the mountainous section, the data indicates the southbound roadway tends to have more severe crashes as compared to the northbound roadway, with four times the number of fatal crashes per year and approximately twice the number of incapacitating injury crashes per year.

2.5 Drainage

2.5.1 Existing Drainage Conditions and Facilities

The existing I-17 roadway alignments (northbound and southbound) are situated between major drainage tributaries. The northbound lanes generally parallel the Agua Fria River and Badger Spring Wash to the east. The southbound lanes generally parallel Black Canyon Creek and Bumble Bee Creek to the west. Relative to these tributaries, the existing I-17 alignments are generally located away from major watercourses, with many smaller washes crossing the existing roadway alignments.

The only major drainage crossings of the existing I-17 alignments are located at the south and north ends of the project. At the south end of the project, the Agua Fria River crosses under I-17 at Black Canyon City. At the north end of the project, Big Bug Creek crosses under I-17 just south of the Cordes Junction TI. Although these bridge crossings are outside the limits of this study, there will be coordination with the adjacent studies and projects to ensure continuity between the proposed drainage elements.

Bridge inspection reports reflect that none of the existing bridges along this section of I-17 have an associated offsite drainage tributary. As-built plans indicate some of the existing drainage culverts date back to the late 1940's and have been extensively lengthened and modified with horizontal and vertical bends. Some of these culverts (pipes and boxes) are undesirably long from a maintenance perspective (300'- 400').

Existing pavement drainage is accomplished by sheet flow off the roadway with runoff intercepted by an open ditch or channel, then conveyed to an offsite cross-drain outfall. At some locations curb has been constructed to intercept the pavement drainage. This curb then conveys the runoff to either down drainpipes or spillways, where the flows are conveyed down the roadway embankment.

2.5.2 Existing Flood Zones

The Flood Zone for Badger Spring Wash approaches the existing northbound roadway in two locations about 1.2 miles south of the Bloody Basin TI. A small tributary of Big Bug Creek is also delineated as a Flood Zone approximately 0.2 miles south of the Big Bug Creek and I-17 crossing.

Several Federal Emergency Management Agency (FEMA) floodplains have been delineated in the general vicinity of the proposed alternatives. Floodplains for the Agua Fria River, Badger Spring Wash, Government Springs Wash and Big Bug Creek may be potentially impacted by at least one of the proposed alternatives.

Within the vicinity of Black Canyon City, the Agua Fria River has been mapped as Flood Zone AE, with an associated floodway. The remaining portions of the Agua Fria River, Badger Springs Wash, Government Springs Wash and Big Bug Creek have been mapped as Flood Zone A. Flood Zone AE is defined as areas where base flood elevations have been determined. Flood Zone A is defined as areas where base flood elevations have not been determined.

2.6 Right-of-Way

Existing right-of-way widths vary widely along the corridor. In areas where the northbound and southbound roadways are parallel, right-of-way widths are generally in the range of 400 feet. In sections where the northbound and southbound alignments are bifurcated and in interchange areas, right-of-way widths increase to as much as 2100 feet.

Several of the wide median areas include BLM-owned land.

2.7 Structures and Geotechnical

2.7.1 General

The ten major bridges, built mostly in the 1960's, are either steel or concrete dual bridges as listed in Table 4.

Table 4 – Existing Structures

STRUCTURE NAME	STRUCTURE NO.	MILEPOST	MIN. VERTICAL CLEARANCE (Ft)
Bumble Bee TI Underpass (UP) SB	1170	248.40	16.4
Bumble Bee TI Overpass (OP) NB	1171	248.40	15.3
Sunset Point TI OP SB	1352	252.50	17.4

STRUCTURE NAME	STRUCTURE NO.	MILEPOST	MIN. VERTICAL CLEARANCE (Ft)
Sunset Point TI OP NB	1237	252.50	16.5
Badger Springs TI OP SB	750	255.90	16.0
Badger Springs TI OP NB	749	256.05	15.1
Bloody Basin TI OP SB	752	259.43	15.9
Bloody Basin TI OP NB	751	259.43	15.2
Big Bug Creek Bridge SB	1039	262.05	N/A
Big Bug Creek Bridge NB	591	262.05	N/A

The Bumble Bee Road TI bridges are separated by approximately 0.25 mile in an area where the northbound and southbound roadways have independent, separated alignments. There are also numerous reinforced concrete box culverts and pipe culverts along the corridor.

Structurally, all of the bridges are in good condition, with sufficiency ratings above 90 except for structure numbers 1039 and 591. The sufficiency ratings for structure numbers 1039 and 591 are 85% and 84% respectively. Some bridges are reported to have functional shortcomings – inadequate underclearances (lateral, vertical, or both) and/or older bridge railing not in conformance with more recent geometric standards.

Overpass Deck Widths

Nine of the ten bridges are overpass bridges, none of which offer adequate surplus deck width for I-17 widening. The Bumble Bee TI OP NB steel bridge and all six reinforced concrete slab bridges can be widened on either or both sides in like kind to accommodate wider I-17 clear roadway. Median side widening has an advantage of utilizing available space within R/W, but one drawback to median side widening is the construction zone ingress/egress constraint. Outside widening offers better construction access, but may infringe on minimum vertical clearance due to cross slope.

Underpass Bridge Openings

The Bumble Bee TI UP SB steel bridge is the only freeway underpass within this project. The skewed main center span must be carefully checked to see if the available bridge opening can accommodate the required I-17 SB roadway width.

Overpass Bridge Openings

All six concrete OP bridges are similar 3-span concrete slab bridges with relatively small center spans over the crossroads. If necessary, it may be possible to re-profile the crossroads to increase vertical underclearance. Current traffic volumes at Sunset, Badger Springs, and Bloody Basin TI crossroads are relatively small; however, the acceptability of the lateral underclearances must be carefully evaluated with respect to future demands.

If the crossroad width increases, or additional lateral underclearance is a necessity, there are at least the following potential alternatives:

- Replace the bridges with similar three-span bridges and increasing the center span.
- Replace the bridges with suitable one-span bridges.
- Evaluate converting an existing end span into a roadway opening by replacing the stub abutment and sloping fill with a full height abutment.

Bloody Basin TI Overpass Structures (looking east)

2.7.2 Geotechnical Profile

Geologic Setting

Within the project limits, I-17 lies primarily in mountainous bedrock terrain along the west edge of the New River Mountains and just east of the larger Bradshaw Mountains. The terrain along the corridor generally consists of rolling hills and ridges typical of mountain foothills at the south and north ends of the corridor and a large flat topped mesa that marks the western edge of the New River Mountains referred to as Black Mesa. Landslide deposits locally occur along the alignment and are exposed just south of and on the approach up to the flat-topped mesa.

Key Geotechnical Issues

Key geotechnical issues associated with the geologic conditions along the current alignment and general corridor includes the following:

Rock cuts. The existing roadway alignment contains considerable rock cuts in a variety of rock types and at a variety of cut slope angles. Larger cuts along the roadway occur as the roadway climbs the grade to the mesa. Slope failures have occurred in these materials and existing treatments include draped mesh over the basalt flow near the top of the mesa and Brugg fences below the mesa. The Brugg fence collect blocks of hard basalt that have fallen as a result of erosion of the underlying softer sedimentary rocks. Further down from the mesa the exposed landslide deposits have experienced slope failures that have consisted of basalt blocks eroding from the slopes.

A fault zone at MP 249.5 is reported to have had ongoing movement and requires continued maintenance. This area is on the approach up to the mesa and appears to be related to slope creep of either landslide deposits or side hill colluvium. Stabilization of this area could include improved drainage control, slope stabilization below the road and possibly installation of geogrid across the area.

Foundation conditions. The corridor is primary underlain by a bedrock environment but includes a variety of rock types. Foundation conditions generally will be good for support of roadways and bridges; however, highly plastic residual clays associated with weathered basalt on the mesa, localized claystones below the basalt flows and landslide deposits along the edge of the mesa may require special attention and treatments beneath roadways.

Foundations for bridges largely could be founded on spread type footings but support on drilled shafts may need to be considered in some conditions.

Embankment fills. Geologic materials exposed along the corridor generally will be suitable for roadway fills and ramps with exception of the highly plastic clay deposits. Also, some of the coarse grained material associated with the colluvium and landslides may require special consideration and handling if used during construction. The anticipated earthwork factors will be highly variable and likely range from a relatively low swell of about 10% for the weathered granites and metamorphics, with a higher swell (20%+) for the basalt.

3.0 Future Conditions

3.1 Related Improvements

A number of other projects are underway in the corridor. A brief description of each project and its status are reflected in the following table.

Table 5 – Related Improvements

PROJECT	STATUS/COMMENT
SB I-17 improvements, MP 245 – MP 250	Superelevation and slope improvements. Construction programmed FY 2008
I-17/SR 69 TI (Cordes Junction)	Construction programmed in 2008
I-17, SR 101L to Black Canyon City Design Concept Study	Complete. Environmental study from New River TI north included in this project.
AFNM and Bradshaw-Harquahala Resource Management Plan and EIS	Underway

3.2 Traffic

3.2.1 2030 Forecast Volumes

A Preliminary Traffic Report (March 2007) was prepared in support of the development of the Design Concept Report for this ADOT project. An earlier traffic report, *I-17 Widening Study, SR 101L to Black Canyon City TI, Traffic Forecast Report*, October 2000, presents traffic volume projections and roadway capacity analyses for I-17 from the New River Road TI at approximately MP 232 to the Black Canyon City TI at approximately MP 244.

The 2025 Average Annual Daily Traffic (AADT) forecast for I-17 south of Black Canyon City contained in the Lima report was 63,400 vehicles per day. The 2025 DDHV projection under urban conditions was 2,600 vehicles per hour. The 2025 DDHV projection under weekend recreational conditions was 5,700 vehicles per hour. In the analysis, a heavy-vehicle adjustment factor of 0.91 was used. The measure of effectiveness used in the report was the Volume to Capacity (V/C) ratio. The weekend recreational projections resulted in a V/C ratio of 0.65 which is borderline Level of Service (LOS) C/D. To achieve LOS C, the report recommended four lanes in each direction.

The traffic analyses herein present traffic volumes projections and roadway capacity analyses for mainline I-17 beginning at the I-17/Black Canyon City TI and extending north to approximately MP 262, south of the Cordes Junction TI. The scope of the study anticipates no major changes to the traffic interchanges. Therefore, no traffic volume projections or ramp terminal capacity calculations were performed as part of the traffic analysis.

Traffic volume projections, K, D, and T factors for the study section of I-17 were provided by ADOT Transportation Planning. The projections are based on a 2030 travel demand model run. The following table shows the two-way annual average daily traffic (AADT) 2030 volume projection. The projection represents a straight-line growth rate of approximately 4.2% per year from 2005 to 2030.

Table 6 – I-17, Mainline Projected Annual Average Daily Traffic (AADT)

YEAR	2030
I-17, Black Canyon City to Cordes Jct.	59,710

Source: ADOT Transportation Planning (March 2007)

It is anticipated the roadway improvements for this section of I-17 will not be designed and constructed within the next five years. Therefore, a design year of 2030 was selected for the analysis of future conditions.

The following projected K, D, and T factors for the study section of I-17 were obtained from the ADOT website, July 2006. K is the percentage of ADT expected in the design hour; D is the percentage of the DHV in the direction of heavier flow, and T is the percentage of trucks expected in the DHV.

- K Factor = 12%
- D Factor = 51%
- T Factor = 19%

The projected K factor is slightly larger than the K factor of 10.6% calculated using the I-17, New River Road ATR data presented in Section 2.4 of this report. The projected D factor is smaller than the D factor of 58.8% presented in Section 2.4 of this report. The Directional Design Hourly Volume (DDHV) is calculated as: DDHV = AADT * K * D. The product of K*D for the New River ATR data is 6.23%, while the product of the projected K*D is 6.12%. Based on this analysis, it was concluded the projected K*D-factor of 6.12% was a reasonable approximation for the calculation of the projected DDHV. The projected 2030 directional design hourly volume is 3,654 vehicles per hour.

3.2.2 2030 Capacity Analysis

General design levels of service and capacity for Arizona state roadways are described in the *Roadway Design Guidelines* from the ADOT Roadway Engineering Group. The design levels of service and capacity for various conditions are shown in Table 103.2A and B of the guideline. The following table summarizes the design levels of service. The Roadway Design Guidelines indicate that where a range is given, the higher level of service should be provided except where costs or environmental constraints dictate a lower level of service.

ADOT Design Levels of Service

Freeway Type	Design Levels of Service
Rural area	
• Level terrain	B
• Rolling terrain	B
• Mountainous terrain	B-C
Urban/ Fringe Urban	C-D

Source: Table 103.2A, ADOT *Roadway Design Guidelines*.

Level of service is a method of describing the operating characteristics of a section of highway. Broadly defined, in terms of traffic flow, LOS A is associated with free flow traffic, LOS B indicates reasonable free flow, LOS C is stable operations, LOS D is the lower range of stable flow, LOS E is unstable flow, and LOS F indicates breakdowns in flow.

The portion of I-17 included in this study area is unique in many ways. Primary factors include the mix of traffic and the connection with major urban areas from northern Arizona. Weekend traffic is approximately 30 percent higher than the average weekday traffic. Recent news reports have also identified Maricopa County as the fastest growing county in the nation. Yavapai County recently has also exhibited explosive growth. As growth continues in Maricopa, Yavapai, and Coconino counties, the area in between will begin to develop into an urban / urban fringe area.

Taking into account the varying traffic demands, mix of vehicles, seasonal travel demand and the urbanization of northern and central Arizona, ADOT has selected LOS C as the appropriate level of service to be utilized for I-17 in this study.

The northern portion of the project (MP 251-262) was evaluated as rolling terrain. The southern portion (MP 245-251) was evaluated using the composite grade methodology for mountainous terrain. Therefore, the northbound and southbound roadways on the southern portion of the project were analyzed separately, based on the specific grades. The capacity calculations were performed using the Highway Capacity Software (HCS2000).

The capacity analyses for the 2030 DDHV indicate the study section of I-17 will operate at LOS F with no roadway improvements. In order to maintain a LOS C in the study section, I-17 must be widened to four lanes in each direction. The northbound roadway in the mountainous section would operate at a borderline LOS C/D. To achieve a solid LOS C in this section, a fifth northbound climbing lane should be considered.

Additional analyses were performed to determine how sensitive the LOS results may be to variations in the traffic volume projections. To perform the sensitivity analysis, the 2030 DDHV was increased by 15% to 4,202 vph and the capacity calculations repeated. The analyses indicate the level of service is somewhat sensitive to the 15% increase in the directional design hourly volume projection. The results generally show the level of service will stay at LOS C with a 15% increase in the DDHV except for the northbound mountainous upgrade, where a fifth lane is required to maintain a LOS C.

3.2.3 Northbound Climbing Lane

The beginning point of a freeway climbing lane depends on the speeds at which trucks approach the grade. According to the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets 2004*, this point should occur at or prior to a 10 mph decrease in truck speed below the average running speed. The distance from the bottom of the grade to the point where truck speeds fall to 10 mph below the average running speed may be determined from Exhibit 3-59 of AASHTO's *A Policy on Geometric Design of Highways and Streets 2004*. The beginning of the climbing lane should be preceded by a tapered section with a desirable taper ratio of 25:1 that should be at least 300 feet long.

The climbing lane should extend to a point beyond the crest, where a typical truck could attain a speed that is within 10 mph of the speed of other vehicles. This distance may be determined from Exhibit 3-60 of AASHTO's *A Policy on Geometric Design of Highways and Streets 2004*. An appropriate taper length should be provided to permit trucks to smoothly merge. AASHTO suggests the ending of the climbing lane should be succeeded by a tapered section with a desirable taper ratio of 50:1 that should be at least 600 feet long. ADOT Roadway Design Guidelines suggest the ending of the climbing lane should be succeeded by a tapered section with a desired taper ratio of the design speed:1.

Based on the criteria established by AASHTO and a normal operating speed of 65 MPH, the northbound climbing lane should begin at approximately MP 244.65 and end at approximately MP 252.00.

3.2.4 Conclusions

The following conclusions were presented in the traffic report:

1. The 2005 AADT reported by ADOT for this section of I-17 (MP 244-MP 262) is 29,100 vehicles per day.

2. The I-17, New River Road automatic traffic recorder is located near the New River Road TI. The following factors were calculated based on the 2005 traffic data collected at this ATR:

- K Factor = 10.6%
- D Factor = 58.8%

3. There was an average of approximately 180 crashes per year within the study area, based on five years of crash data.

4. There tends to be more crashes in the northbound direction as compared to the southbound direction.

5. The crashes in the southbound direction tend to be more severe than the crashes in the northbound direction.

6. The average number of crashes per mile tends to be much higher in the mountainous terrain as compared to the rolling terrain.

7. Rear-end crashes are the predominant manner of collision on the northbound roadway in the mountainous area.

8. Single vehicle crashes are the predominant manner of collision on the southbound roadway in the mountainous area.

9. The 2030 AADT projected by ADOT for the study section of I-17 is 59,710 vehicles per day.

10. The ADOT projected 2030 traffic factors are as follows:

- K Factor = 12%
- D Factor = 51%
- T Factor = 19%

11. The calculated 2030 DDHV for the study section is 3,654 vehicles per hour.

12. In order to maintain a LOS C in the study section, I-17 must be widened to four lanes in each direction, with an additional fifth (climbing) lane in the northbound direction in the mountainous portion of the project. ADOT has selected Level of Service C as the appropriate level of service to be utilized for I-17 in this study.

13. Based on the criteria established by AASHTO and a normal operating speed of 65 MPH, the northbound climbing lane should begin at approximately MP 244.65 and end at approximately MP 252.00.

3.3 Drainage

Design criteria, hydrology, hydraulics, and scour will be considered at each offsite drainage facility. For existing culverts, the estimated runoff discharges will be compared to the culverts' hydraulic capacity to help evaluate the adequacy of the existing facilities. Retrofit of existing structures will be oriented toward protecting function and integrity versus upgrading to simply meet current drainage design criteria. Existing drainage facilities will be upgraded if they do not meet the 25-year design criteria. New drainage facilities will be sized for the 50-year rainfall event, based on the preliminary hydrologic and hydraulic analyses.

Required drainage improvements for sections of existing roadway will consist of extending existing culverts and relocating existing roadside ditches. Depending on the preferred alternative, new culverts, bridges and scour countermeasures will be needed. In locations where new roadway cuts are required, crown ditches maybe necessary. Right-of-way needs related to new roadside ditches, crown ditches, and ponding areas will be identified in the Preliminary Drainage Report.

New onsite drainage facilities will include area type inlets, down drains, and roadside ditches. In the vicinity of new guard rail installations, curb may be required to intercept roadway sheet flow, and convey the discharges to new spillways and/or new down drainpipes. Onsite drainage facilities will be designed for the 10-year rainfall event.

Additional drainage analyses necessary to present drainage solutions to existing issues, and preliminary sizes of the required new drainage elements for the preferred alternative will be presented in the Preliminary Drainage Report for this project.

4.0 Alternative Selection Process

4.1 Introduction

Nine alignment alternatives were developed for this study for consideration with the No Build alternative. These include improvements to the existing northbound and southbound roadways (Alternative A), two new alignments to the east (Alternatives B and C) and three to the west (Alternatives F, G and H) of the existing alignments, and three that fall within the vicinity of the existing northbound and southbound roadways (Alternatives D, D-1, and E).

These concept-level alternatives were developed to represent potential corridors in which alignments may be developed further if such corridors are recommended to be evaluated in more detail. The preliminary horizontal and vertical alignments have been developed; however, it is likely that those alternatives carried forward in the study process will be modified to optimize each alignment.

4.2 Preliminary Design Criteria

As discussed previously, four lanes in each direction were recommended from the New River Road TI to the Black Canyon City TI in the *Final Design Concept Report, I-17 Widening Study, SR 101L TI to Black Canyon City TI* (October 2004). The existing northbound and southbound roadways will be widened using a combination of inside and outside widening. Design criteria and concept-level design for this segment are available in the DCR.

The new lanes in the I-17 corridor north of Black Canyon City will be designed to meet ADOT and the AASHTO design criteria. Table 7 presents the preliminary design criteria for the mainline widening.

Table 7 – Preliminary Roadway Design Criteria

DESCRIPTION OF CRITERION	VALUE FOR DESIGN
Design Year:	2030
Elevation Range:	2,100 ft. to 3,800 ft.
Level of Service: MP 244.5 to 250.5 MP 250.5 to 262.0	 C C
Normal Cross Slope:	2.0%
Superelevation: MP 244.5 to 262.0	 e_{max}=0.10 ft./ft.
Design Speed: Mainline: (MP 244.5 to 250.5) (Controlled Access Highway, mountainous terrain) (MP 250.5 to 262.0) (Controlled Access Highway, rolling terrain) Ramp Exit at Mainline Gore: Taper-Type Parallel-Type Ramp Entrance: Ramp Body: Ramp Terminus: Crossroad:	 65 mph 75 mph Mainline design speed minus 10 mph Mainline design speed minus 5 mph Mainline design speed minus 10 mph 50 mph 35 mph 40 mph, but not less than design speed of crossroad approaches to the interchange
Lane Width:	12 ft.
Outside Shoulder Width:	12 ft. (incl. 2' offset to barrier (truck DDHV > 250)
Inside Shoulder Width:	12 ft. (incl. 2' offset to barrier (truck DDHV > 250)
Median Width:	84 ft. desirable (50 ft. minimum)
Median Barrier	Required: 1.) If Median width ≤ 30 ft., or 2.) If Median width ≤ 75 ft. and natural barriers are not present with 3 or more lanes in each direction
Minimum Horizontal Curve Length: MP 244.5 to 250.5 MP 250.5 to 262.0	15 x design speed (mph): 975 ft. 1125 ft.
Maximum Degree of Curve: MP 244.5 to 250.5 MP 250.5 to 262.0	 4°16' 2°54'
Maximum Gradient: Mainline: MP 244.5 to 250.5 MP 250.5 to 262.0 Ramps: Upgrade Downgrade	 5% 4% 4% 5%
Side Slope:	ADOT Standard C-02.10
Minimum Vertical Curve Length:	1000 ft
Taper Rate (Lane Drop): MP 244.5 to 250.5 MP 250.5 to 262.0 Taper Rate (Lane Addition): MP 244.5 to 262.0	Design speed(mph) to one: 65:1 75:1 25:1
Minimum Vertical Clearance: Overpass Underpass Tunnel Sign Structure	 15.5 ft. (16.5 ft. where high truck volumes) 16.5 ft. 16.0 ft. 17.5 ft

4.3 Alignment Alternatives

In addition to the No Build alternative, a total of nine alignment alternatives have been developed for the segment of I-17 between the Black Canyon City TI and Jct. SR 69. These alternatives have been separated into four groups based on location. The first is Alternative A which widens and improves the existing northbound and southbound roadways on the existing alignments. Alternatives B and C realign the highway to the east of existing I-17. Alternatives D, D-1, and E realign the highway near the existing highway. Alternatives F, G, and H realign the highway in corridors west of existing I-17.

These alternatives are currently being considered as independent alignment alternatives. However, the alternatives carried forward in the design concept process will be considered in combination with the existing roadway in a later phase of this study. For example, an alternative alignment in combination with the existing I-17 roadways would provide the number of lanes required based on future projections. The new segment of the alternative alignment could be a four-lane facility for one direction of travel or could be split both directions with a median barrier or a median.

4.3.1 Mainline Widening

Alternative A

Alternative A consists of widening the existing northbound and southbound alignments. Two lanes and additional shoulder width are required in both directions. A climbing lane would be added in the northbound direction from MP 244.65 to 252.00.

This alternative would likely consist of a combination of widening to the inside and outside of the existing roadways, and would need to be done with traffic in place. The combination of construction on steep terrain next to high-speed traffic will present many engineering challenges. The completed reconstruction should also serve to improve roadway geometry.

The existing roadway geometry for both directions includes several horizontal curves with minimum allowable radii, resulting in sharp curves with limited sight distance. Some modifications to the existing horizontal geometry could be included with Alternative A. Increasing sight distance can be achieved by cutting back slopes to provide better visibility in key locations.

There are a number of existing curves where the superelevation does not meet current design criteria. Alternative A would need to completely reconstruct the existing pavement where it does not meet current criteria.

The existing northbound and southbound vertical profiles employ maximum grades of 6%, which are sustained for several miles. This alternative would not change the profile grade and design exceptions would be required.

Maintaining traffic during construction to improve the existing roadways would be a difficult and expensive undertaking. Construction would be very disruptive to existing I-17 traffic and be very lengthy due to high existing traffic volumes and no alternate route during construction. In addition, earthwork operations, including blasting and potential rock fall hazards, would require complete closures of both lanes in at least one direction and possibly both directions depending on the proximity of the traffic.

4.3.2 East Alternative Alignments

Two new alignments were developed to the east of the existing corridor. These alternative alignments along with Alternative A are shown on Figure 2. The concept-level profiles of Alternatives A and B as well as the existing northbound and southbound profiles of I-17 are shown on Figure 3.

Alternative B

Alternative B consists of a new alignment beginning approximately 0.5 mile south of the Black Canyon City TI and ending approximately one mile south of the Sunset Point TI. East of existing I-17, this alignment generally lies within the Agua Fria National Monument. Once the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound alignments north to the project limit. Widening would be to the inside, outside, or a combination of each. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

Alternative B would depart from the existing highway alignment south of the Black Canyon City TI, near the Agua Fria River bridge. This area of Black Canyon City has various residential and commercial developments; numerous buildings would likely be adversely impacted.

The alignment continues up along a canyon within the Agua Fria National Monument to the top of Black Mesa. Several large structures may be required for the alignment to cross from one canyon side to the other. The alignment would then proceed approximately 1.5 miles parallel to the existing I-17 corridor along the Black Mesa until it ties back into the existing highway south of the Sunset Point TI.

The vertical profile for this corridor would consist of a sustained grade of 5% for approximately 4.5 miles. Landings or interruptions of the maximum sustained grade could be provided by additional earthwork or by a steeper grade. Once at the top of Black Mesa, the grade would be relatively flat as follows the terrain until it ties back in with the existing I-17 profile.

A connection to Bumble Bee Road could be accommodated by the construction of a new traffic interchange east of existing I-17 on Black Mesa with an approximately two-mile long crossroad traversing down through a canyon to the west to connect to the existing Bumble Bee Road. This cross road would have steep grades and would require significant earthwork to construct.

Alternative B would potentially impact the floodplain along the Agua Fria River at the southern end of the proposed alignment. This potential encroachment into the floodplain is considered to be minor; however, floodplain impacts would need to be analyzed.

Alternative C

Alternative C consists of a new alignment beginning approximately 0.5 mile north of the Black Canyon City TI and ending approximately one mile south of the Sunset Point TI. East of existing I-17, this alignment also generally lies within the Agua Fria National Monument. Where the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound roadways to the inside, outside, or a combination of both. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

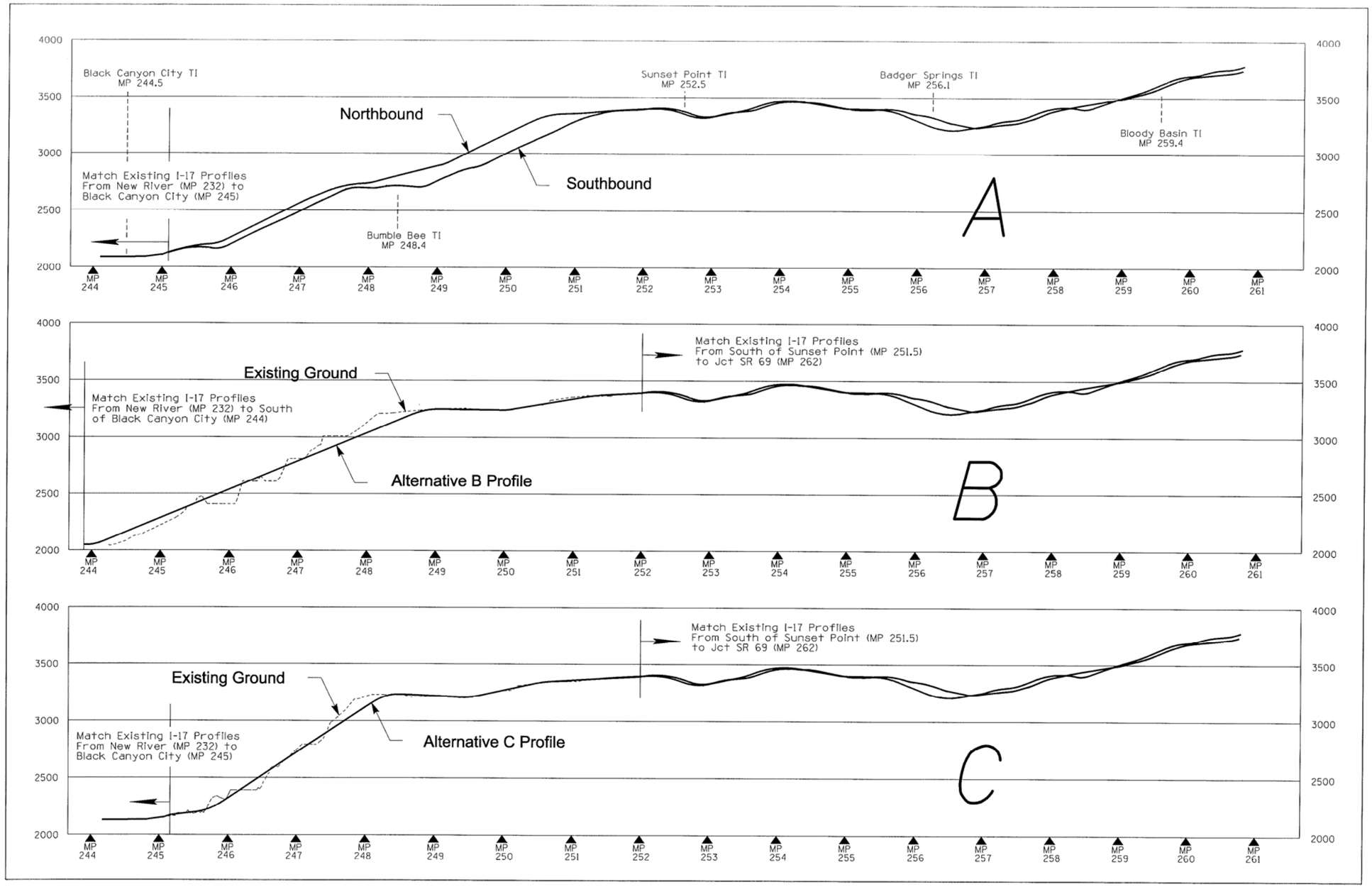
Alternative C would begin north of the Black Canyon City TI; no structures in Black Canyon City would be impacted. The corridor would travel east of the existing highway and climb steep canyon sides within the Agua Fria National Monument to the top of Black Mesa. Similar to Alternative B, this corridor would proceed north approximately one mile parallel to the existing I-17 corridor along the Black Mesa until it ties back into the existing highway south of the Sunset Point TI.

The vertical profile for this alternative would consist of a sustained 10% grade for several miles. Once at the top of Black Mesa, the grade would be relatively flat as follows the terrain until it ties back in with the existing I-17 profile. The 10% grade would exceed maximum grades allowed by ADOT's *Roadway Design Guidelines* (5% maximum in mountainous terrain).

A western connection to Bumble Bee could be accommodated by a construction of a new traffic interchange east of existing I-17 on Black Mesa with an approximately two-mile long crossroad traversing down through a canyon to the west and eventually connecting to the existing Bumble Bee Road. This crossroad would have steep grades and would require significant earthwork to construct.

FIGURE 2 – EAST ALTERNATIVE ALIGNMENTS

FIGURE 3 – EAST ALTERNATIVE PROFILES



4.3.3 Middle Alternative Alignments

Three new alternative corridors were developed near the existing highway. These alternatives, along with Alternative A, are shown on Figure 4. Concept-level profiles for Alternatives D, D-1, and E are reflected on Figure 5.

Alternative D

Alternative D consists of a new alignment in the median area between the existing northbound and southbound roadways. The alignment begins approximately 0.5 mile north of the Black Canyon City TI and ends approximately one mile south of the Sunset Point TI. Once the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound roadways north to the project limit. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

This alternative would utilize the existing median area between the existing northbound and southbound alignments of I-17. At its south end, the alignment would run parallel to the existing northbound alignment. The alignment would cross over the existing southbound alignment and continue along its west side. Before reaching the existing Bumble Bee TI, the new alignment would cross over the existing southbound alignment and Bumble Bee Road. There is potential to add ramps at this location to access Bumble Bee Road. Finally, this new alternative would follow along the west side of the existing northbound alignment within the existing median and tie back in to the existing alignments south of the Sunset Point TI.

The vertical profile for this alternative would consist of 4% to 5% grades to the top of Black Mesa. Once at the top of Black Mesa, the grade would be relatively level as the highway follows the terrain to connect with the existing I-17 profile.

Four large structures would be required for this alternative. Two structures would be necessary to cross over the existing highway. Another structure would be approximately 0.5 mile long to bridge rough terrain.

Alternative D would be disruptive to traffic because of its proximity to the existing roadways.

Alternative D-1

Alternative D-1 consists of a new alignment beginning north of the Black Canyon City TI and ending south of the Sunset Point TI. Alternative D-1 would use a series of tunnels to traverse the mountainous terrain. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

The tunnel allows flexibility in horizontal and vertical layout, resulting in a simple horizontal alignment and constant profile grade. This alternative would utilize the existing right-of-way between the existing northbound and southbound I-17 roadways. At its south end, the alignment would run parallel to the existing northbound I-17 alignment. The alignment would cross over the existing southbound I-17 alignment and continue along its west side. South of the existing Bumble Bee TI, the new alignment would tunnel under existing southbound I-17 roadway once and existing northbound I-17 roadway twice, as well as under existing Bumble Bee Road. There is the potential to create a new traffic interchange approximately 2000 feet north of the existing Bumble Bee TI to maintain access to Bumble Bee Road. Traversing the existing median, this segment of the alignment would include some cut and fill sections followed by the second of the mile-long tunnels. Once the tunnel reaches the top of the Black Mesa, the alignment would tie back into the existing highway south of the Sunset Point TI. Northbound and southbound I-17 would be widened from this point north to the project limit.

The vertical profile for this alignment would consist of 1% to 5% grades as it climbs the Black Canyon hill. Once at the top of Black Mesa, the grade would become relatively flat as follows the terrain until it ties back in with existing I-17 profile.

Hazardous cargo may not be permitted to pass through a tunnel. Therefore, Alternative D-1 would likely need to be supplemented by maintaining one of the existing I-17 roadways or by another route acceptable for hazardous cargo.

Preliminary geotechnical analysis has determined that soils in this area are unsuitable for tunneling.

Alternative E

Alternative E consists of a new alignment west of the existing southbound I-17 roadway beginning approximately 0.5 mile north of the Black Canyon TI and ending approximately one mile south of the Sunset Point TI. As with the other alternatives, once the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound north to Cordes Junction. Widening would consist of adding lanes to the inside of the existing roadways, the outside, or a combination of both. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

This alternative is a similar to Alternatives D and D-1 in that it maintains a close proximity to the existing I-17 roadways. At the south end of the alignment, Alternative E would be located in the existing median area. The alignment would cross above the existing southbound I-17 alignment and continue in a northwest direction before turning back toward the existing Bumble Bee TI. There is potential to create a new interchange 2000 feet north of the existing Bumble Bee TI to maintain access to Bumble Bee Road. Alternative E would use the existing median, then swing out to the west to climb to the top of the Black Mesa. Finally, the new alignment would connect back to the existing alignments south of the Sunset Point TI.

The vertical profile for this alternative would consist of grades ranging from 0.5% to 5% to the top of Black Mesa. Once at the top of Black Mesa, the grade would be relatively flat as Alternative E follows the terrain until it ties back in with the existing I-17 roadways.

This alternative potentially impacts one of the Arizona Game & Fish wildlife water catchments.

FIGURE 4 – MIDDLE ALTERNATIVE ALIGNMENTS

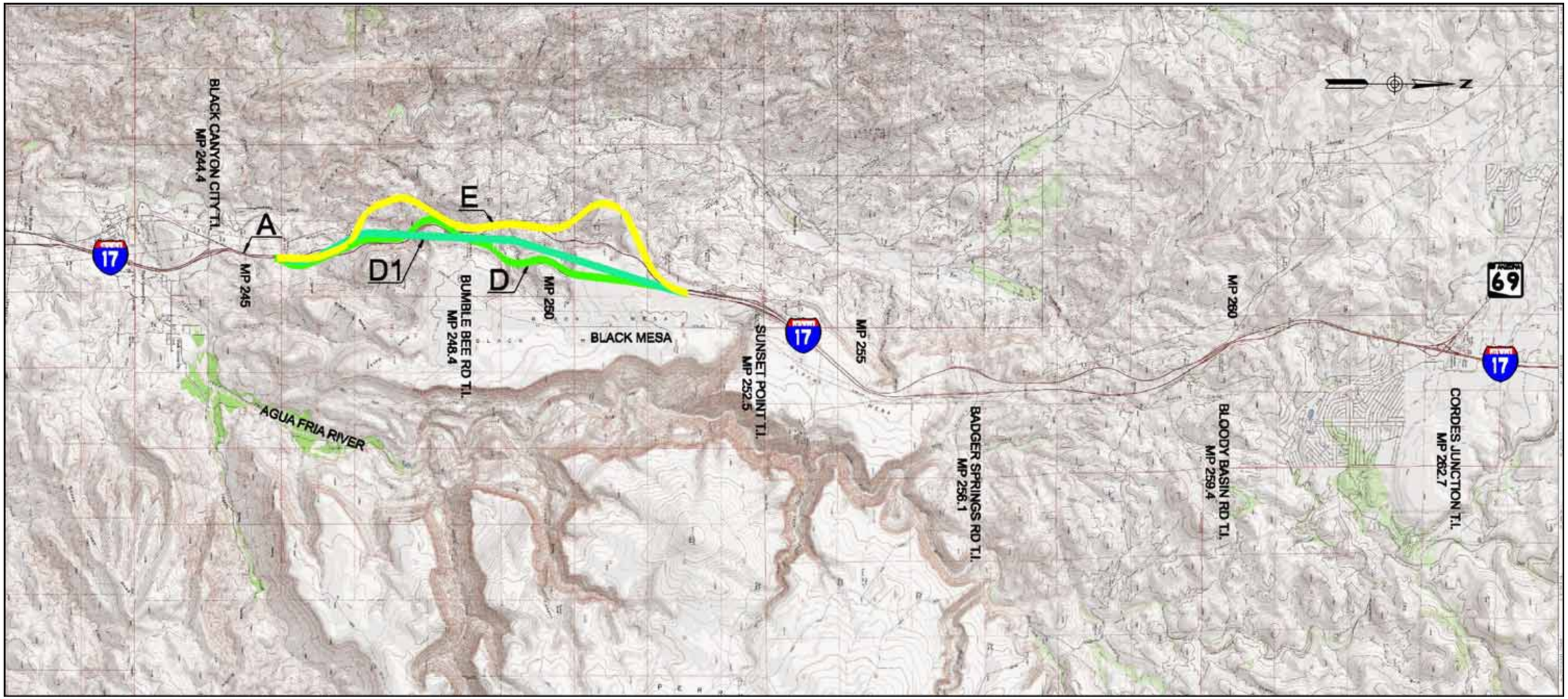
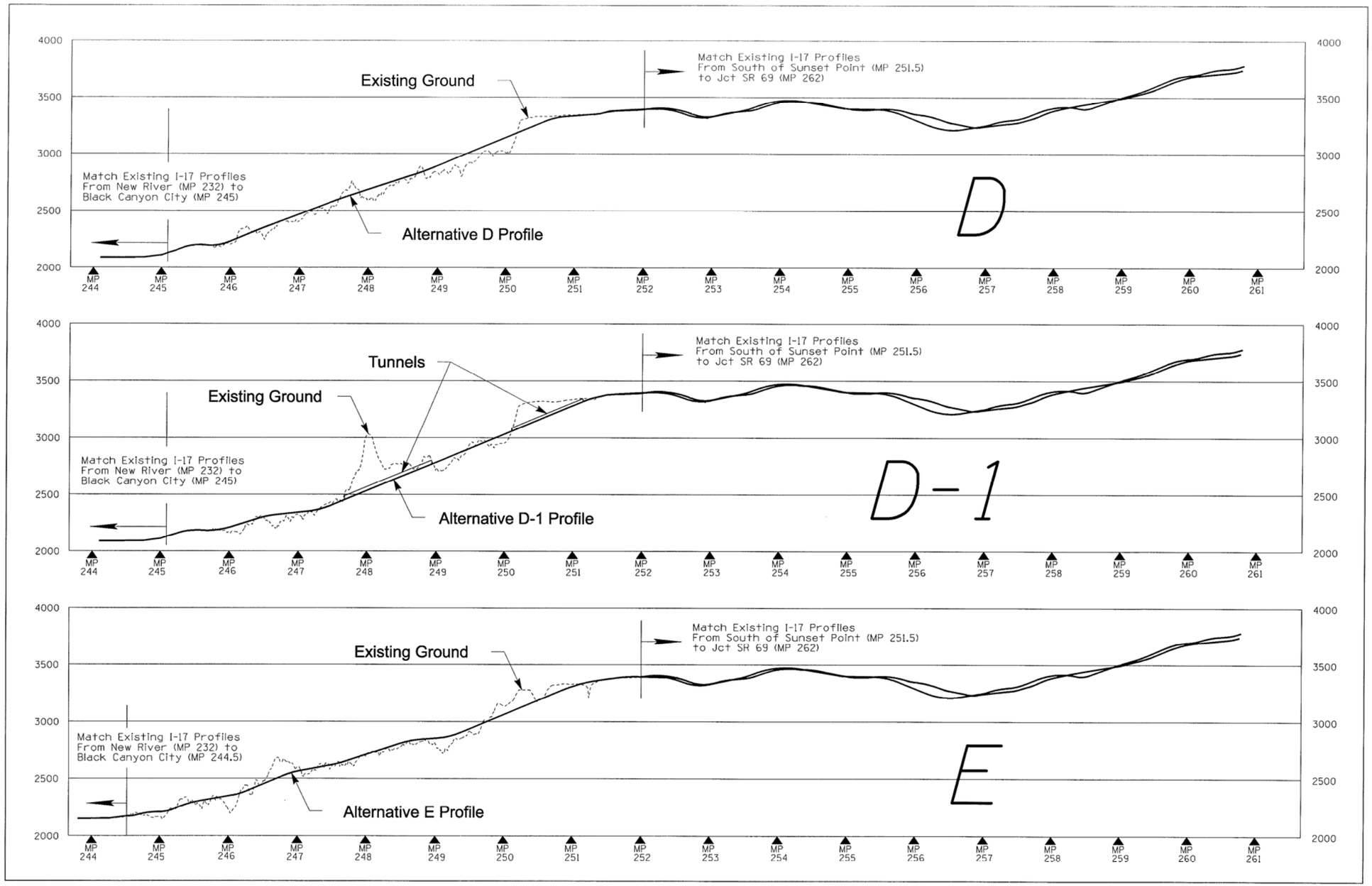


FIGURE 5 – MIDDLE ALTERNATIVE PROFILES



4.3.4 West Alternative Alignments

Three new alternatives are located west of the existing highway. All three of these alternatives follow the same alignment in their southern segments. The differences between the alternatives are the overall lengths of the new alignment and the connection point to the existing northbound and southbound alignments. These alternatives are shown on Figure 6, with concept-level profiles on Figure 7.

Alternative F

Alternative F consists of a new alignment beginning approximately 0.5 mile north of the Black Canyon City TI and ending approximately one mile south of the Sunset Point TI. Once the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound alignments north to Jct. SR 69. Widening of the existing roadways would be to the inside, the outside, or both. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

North of the Black Canyon City TI, the alignment would cross over the existing southbound I-17 alignment and continue in a northwest direction.

The new alignment would continue north and follow alongside the existing Maggie Mine Road and Crown King Road (Old Route 69) alignments. There is potential to construct a new traffic interchange to connect to Bumble Bee Road. Next, the new alignment would travel east toward the existing I-17 and up the face of Black Mesa. Finally, the new alignment would connect back to the existing alignments south of the Sunset Point TI.

The vertical profile for this alternative would consist of rolling profile in its southern segment. The climb to the top of Black Mesa would consist of a combination of a 5% grade followed by a 10% grade. Once at the top of Black Mesa, the grade would be relatively flat as it follows the terrain until it ties back in with the existing I-17 profile. The 10% grade would exceed the maximum grade allowed by ADOT's *Roadway Design Guidelines*.

Alternative G

Alternative G consists of a new alignment beginning approximately 0.5 mile north of the Black Canyon City TI and ending at approximately the Badger Springs Rd TI. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

Alternative G follows the same alignment as Alternative F south of the existing Bumble Bee Road TI. North of Bumble Bee Road, Alternative G remains closer to the existing Crown King Road alignment and passes to the east of Bumble Bee Ranch. From there, the alignment climbs and connects with existing I-17 near the Badger Springs Rd TI.

As with Alternative F, a new interchange could potentially be constructed to connect to Bumble Bee Road. Alternative G continues along the bottom and the side of the canyon. Because of the elevation difference, access to the Sunset Point TI and rest area may be impacted with Alternative G. Once the alignment ties back in with existing I-17, the alternative would consist of widening the existing northbound and southbound alignments north to the project limit.

The vertical profile for Alternative G follows the rolling terrain for several miles with grades of up to 5%. The profile ascends at a 5% grade for several miles. There are several deep cut sections in this area and long fill slopes are anticipated due to the skew of the roadway up the side of the hill.

Alternative G will potentially have a minor impact on the floodplain for two small tributaries of Bumble Bee Creek, Sheep Gulch and an unnamed tributary 0.25 mile northeast of Sheep Gulch. This alternative may impact AGFD's northern wildlife water catchment.

Alternative H

Alternative H consists of a new alignment beginning 0.5 mile north of the Black Canyon City TI and ending at approximately the Bloody Basin Rd TI. Four lanes would be provided in both directions; a climbing lane would be considered in areas of sustained uphill grades.

Alternative H follows the same alignment as Alternative G east of Bumble Bee Ranch. North of the ranch, Alternative H remains to the east of Bumble Bee Creek for approximately three miles. The new alignment continues northward, then winds up the hillside and connects to the existing highway near the Bloody Basin Rd TI. Once the alignment ties back in with the existing I-17 alignment, the alternative would consist of widening the existing northbound and southbound roadways to the inside, the outside, or a combination of both.

The vertical profile for Alternative H is the similar to Alternative G. The profile is constant with an upgrade of approximately 1% where the roadway follows along the east side of the Bumble Bee Creek valley. Where the roadway travels up the mesa, the grades increase to 5% for several miles. As with Alternative G, several deep cut sections and long fill slopes are anticipated due to the skew of the roadway up the side of the hill.

Because of the elevation difference, Alternative H will likely impact access to the Sunset Point TI and rest area as well as Badger Springs Road.

FIGURE 6 – WEST ALTERNATIVE ALIGNMENTS

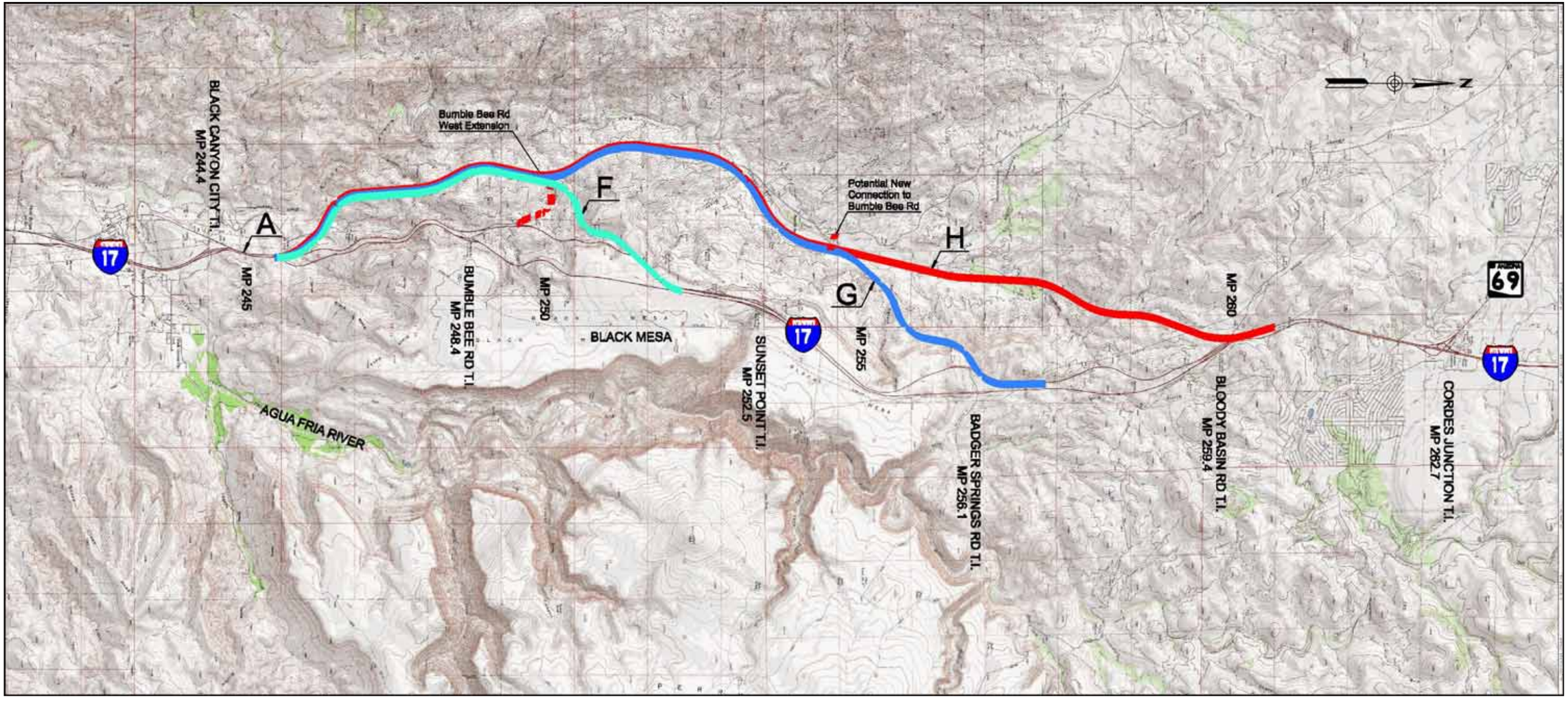
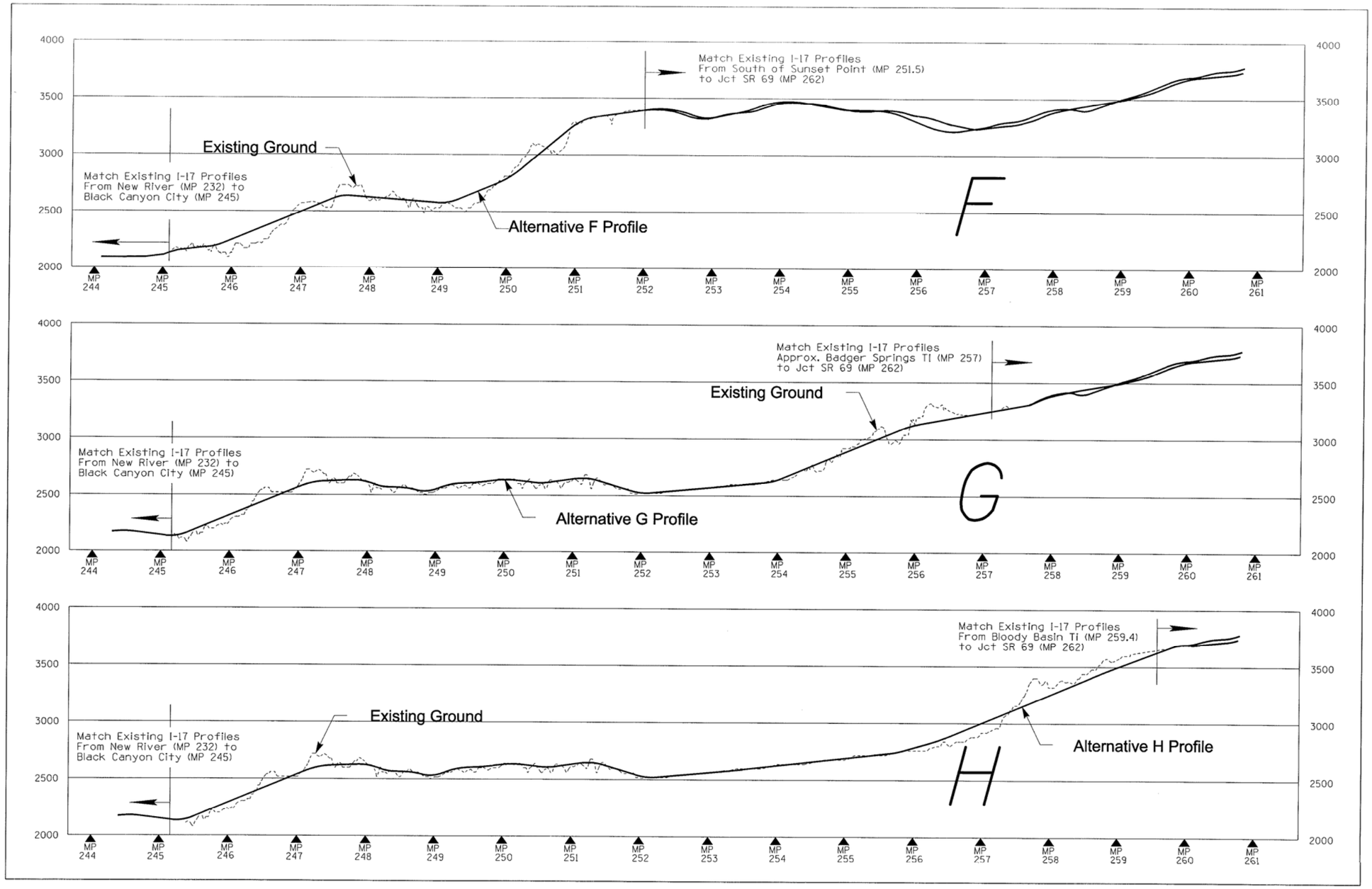


FIGURE 7 – WEST ALTERNATIVE PROFILES



5.0 Environmental Overview

5.1 Introduction

The 30-mile environmental study area begins at the New River traffic interchange at MP 232.0 on I-17 in Maricopa County and extends north to the I-17/Junction SR 69 TI at MP 262.0 in Yavapai County.

Coordination with federal, state, and local agencies and the public was conducted to obtain information about the environmental resources in the general project area. Specific information was also obtained to define the existing social, economic, and environmental characteristics of the I-17 corridor and assist the study team in identifying particular constraints to be considered in the development and preliminary analysis of alternatives. Future analyses will address environmental considerations in detail, and specific mitigation measures will be identified as part of those analyses and documentation.

Based on a review of the project area, there are no prime and unique farmlands, sole source aquifers, wetlands, designated critical habitat, or wild and scenic rivers present in the project area. The following sections of this Environmental Overview (EO) summarize current information and identify the level of concern or sensitivity for each environmental issue.

5.2 Biological Resources

5.2.1 Biological Community

The southern portion of the project area passes through the Arizona upland subdivision of Sonoran desert scrub (Turner and Brown 1994), transitioning into semidesert grasslands (Brown 1994) on top of Black Mesa, which continue through the north end of the project at Cordes Junction. The majority of adjacent land in the project area is under the jurisdiction of the BLM, including the Agua Fria National Monument. The project also passes through private and Arizona State Trust lands, mostly in the areas surrounding New River, Black Canyon City, and Cordes Junction.

On the south end of the corridor, I-17 follows the New River Valley, slowly rising from 2,000 feet to 2,240 feet elevation, where New River turns to the east, away from I-17. The New River Mountains are east of the project area, and the Agua Fria River Valley and Bradshaw Mountains are to the west. North of New River, I-17 drops in elevation until it crosses Moore Gulch and Little Squaw Creek, tributaries of the Agua Fria River, at 2,000 feet, and continues until crossing the Aqua Fria River in Black Canyon City at MP 243.4. North of the Agua Fria River crossing, I-17 climbs the slopes of Black Mesa, cresting at 3,300 feet elevation on flat terrain. I-17 then crosses Black Mesa, past Sunset Point, with Big Bug Creek Valley to the west and the Agua Fria River Valley to the east. At the northern end of Black Mesa, I-17 rises again toward Cordes Junction and the Big Bug Creek crossing at 3,800 feet elevation.

The Arizona subdivision of the Sonoran desert scrub biotic community is dominated by paloverde (*Parkinsonia* microphylla), desert ironwood (*Olneya tesota*), mixed cacti, and desert shrubs. For most of the project corridor, this community is relatively undisturbed, with exceptions located around New River and Black Canyon City. Sonoran desert scrub gives way to semidesert grasslands as I-17 crests the top of Black Mesa. This biotic community is dominated by perennial grasses and shrubs intermixed with prickly pear (*Opuntia* spp.), yucca (Yucca spp.), and agave (*Agave* spp.). Some areas of the community in the project area have been heavily grazed or affected by wildfires but remain relatively undisturbed by urban development until near Cordes Junction.

5.2.2 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) lists of threatened, endangered, proposed, and candidate species for Maricopa and Yavapai counties were reviewed by a qualified biologist. Table 8 summarizes these lists and identifies habitat requirements and potential occurrences of each species along the I-17 corridor. No federally protected species were observed during a general site survey on September 27, 2006. In addition, no designated or proposed critical habitat occurs along the I-17 corridor.

Table 8 – Potential Occurrences of USFWS Listed Species

Name	Status	Habitat Requirements	Occurrence Potential
Arizona cliffrose *Purshia subintegra*	E	Characteristic white soils of tertiary limestone lakebed deposits. Elevation: <4,000 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 25 miles east at Horseshoe Reservoir.
California brown pelican *Pelecanus occidentalis californicus*	E	Coastal land and islands; species found around many Arizona lakes and rivers. Elevation: varies.	There is no suitable habitat in the project area and no potential for occurrence.
Chiricahua leopard frog *Rana chiricahuensis*	T	Streams, rivers, backwaters, ponds, and stock tanks mostly free from introduced fish, crayfish, and bullfrogs. Elevation: 3,300 to 8,900 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 30 miles east, along the Verde River.
Colorado pikeminnow *Ptychocheilus lucius*	E	Warm, swift, turbid mainstem rivers. Prefers eddies and pools. Elevation: <4,000 feet.	Project area lies outside historical range. The closest known existing population is approximately 25 miles east, in the Verde River, outside of the Agua Fria River system. No potential for occurrence.
Desert pupfish *Cyprinodon macularius*	E	Shallow springs, small streams, and marshes. Tolerates saline and warm water. Elevation: <5,000 feet.	Populations are known to exist within Lousy Canyon, a tributary of the Agua Fria River, approximately 2 miles east of the project area. Individuals may follow flowing waters downstream from known populations into the project limits.
Gila chub *Gila intermedia*	E	Pools, springs, cienegas, and streams. Elevation: 2,000 to 5,500 feet.	Populations are known to exist within Silver Creek and Sycamore Creek, tributaries of the Agua Fria River, approximately 3 miles east of the project area. Individuals may follow flowing waters downstream from known populations into the project limits.
Gila topminnow *Poeciliopsis occidentalis occidentalis*	E	Small streams, springs, and cienegas with vegetated shallows. Elevation: <4,500 feet.	Populations are known to exist within Tule Creek, Lousy Canyon, and AD Wash, all tributaries of the Agua Fria River; the closest to the project area is Lousy Canyon, approximately 1.5 miles east of the project area. Individuals may follow flowing water upstream or downstream from known populations into the project limits.
Headwater chub *Gila nigra*	C	Small to medium-sized streams; often associated with deep pools and cover such as boulders or vegetation. Elevation: 3,000 to 6,700 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 25 miles east along the Verde River. No potential for occurrence.
Lesser long-nosed bat *Leptonycteris curasoae yerbabuenae*	E	Desertscrub habitat with agave and columnar cacti present as food plants. Elevation: <6,000 feet.	Although suitable foraging habitat may exist in the project area, no roosts are known to occur. The closest population is approximately 30 miles southeast of the project area.
Mexican spotted owl *Strix occidentalis lucida*	T	Nests in canyons and mixed conifer or mature ponderosa pine–Gambel oak forests with multilayered foliage structure. Cool microclimates appear to be important. Uses a variety of habitat for foraging. Elevation: 4,100 to 9,000 feet.	No suitable habitat occurs in the project area. Closest known population is approximately 15 miles west of the project area, in the Bradshaw Mountains. No potential for occurrence.
Page springsnail *Pyrgulopsis morrisoni*	C	Aquatic, slow, or still freshwater; usually head springs and upper section of outflows. Elevation: 3,300 to 3,600 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 30 miles north of the project area, within the Verde River drainage. No potential for occurrence.

Table 8 – Potential Occurrences of USFWS Listed Species

Table 8 – Potential Occurrences of USFWS Listed Species

Name	Status	Habitat Requirements	Occurrence Potential
Razorback sucker *Xyrauchen texanus*	E	Riverine and lacustrine areas. Generally not in fast-moving water. May use backwaters. Elevation: <6,000 feet.	Project area lies outside historical range. The closest known existing population is approximately 25 miles east, in the Verde River. No potential for occurrence.
Sonoran pronghorn *Antilocapra americana sonoriensis*	E	Broad intermountain alluvial valleys with creosote-bursage and paloverde–mixed cacti associations. Elevation: 2,000 to 4,000 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. Project area lies outside historical range. The closest known existing population is approximately 80 miles southwest of the project area. No potential for occurrence.
Southwestern willow flycatcher *Empidonax traillii extimus*	E	Cottonwood-willow and tamarisk vegetation communities along rivers and streams. Elevation: <8,500 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest known population is located near Camp Verde, approximately 20 miles northeast of the project area. Low potential for occurrence.
Spikedace *Meda fulgida*	T	Moderate to large perennial streams with gravel cobble substrates and moderate to swift velocities over sand and gravel substrates. Recurrent flooding and natural hydrograph important. Elevation: <6,000 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 40 miles north of the project area, in the Verde River system. No potential for occurrence.
Yellow-billed cuckoo *Coccyzus americanus*	C	Large blocks of riparian woodlands. Cottonwood, willow, or tamarisk galleries. Elevation: <6,500 feet.	Some suitable habitat may exist in the project area, and populations are known to occur. Individuals have been detected along Bumble Bee Creek and the Agua Fria River in the project area.
Yuma clapper rail *Rallus longirostris yumanensis*	E	Fresh water and brackish marshes. Elevation: <4,500 feet.	Although some suitable habitat may exist in the project area, no populations are known to occur. The closest population is approximately 25 miles east of the project area, along the Verde River, and 25 miles south, along the Salt River. Low potential for occurrence.

C = Candidate, E = Endangered, T = Threatened (USFWS 2006a, 2006b)

5.2.3 Bureau of Land Management and Wildlife of Special Concern in Arizona

BLM's sensitive species list (BLM 2005) and the Arizona Game and Fish Department (AGFD) list of Wildlife of Special Concern in Arizona (WSCA) (AGFD 1996) were reviewed by a qualified biologist. Table 9 provides a list of the BLM sensitive species and WSCA that have the potential to occur in the project area. No BLM sensitive species or WSCA were observed during the September 27, 2006, general site survey.

Table 9 – BLM Sensitive Species and WSCA with Potential to Occur along the Corridor

Taxon	Scientific Name	Common Name	BLM[1]	WSCA[2]
Mammals	*Macrotus californicus*	California leaf-nosed bat		X
	Myotis velifer	Cave myotis	X	
	Nyctinomops femorosaccus	Pocketed free-tailed bat	X	
	Lasiurus blossevillii	Western red bat		X
	Lasiurus ega	Southern yellow bat		X
Birds	*Ceryle alcyon*	Belted kingfisher		X
	Buteogallus anthracinus	Common black-hawk		X
Reptiles	*Gopherus agassizii*	Sonoran desert tortoise		X
	Thamnophis eques	Mexican garter snake		X
Amphibians	*Rana yavapaiensis*	Lowland leopard frog		X
Fish	*Catostomus clarki*	Desert sucker	X	
	Agosia chrysogaster chrysogaster	Gila longfin dace	X	
	Rhinichthys osculus	Speckled dace	X	
Invertebrates	*Cicindela oregona maricopa*	Maricopa tiger beetle	X	
Plants	*Fremontodendron californica*	California flannelbush	X	
	Agave murpheyi	Murphey agave	X	

[1] (BLM 2005); [2] (AGFD 1996)

5.2.4 Protected Native Plants

The Arizona Department of Agriculture (ADA) list of protected native plants (ADA 2005) was reviewed by a qualified biologist. Numerous individuals of Arizona protected native plants were observed along the I-17 corridor. These plants included agaves, barrel cactus (*Ferocactus* spp.), prickly pear, cholla (*Cylindropuntia* spp.), yuccas, mesquites (*Prosopis* spp.), and paloverde. Additionally, though not observed during the September 27, 2006, general site survey, two salvage restricted plants potentially could occur in the project area: Bigelow onion (*Allium bigelovii*) and Mazatzal triteleia (*Triteleia lemmoniae*).

5.2.5 Invasive Species

An evaluation for the presence of invasive species was not conducted for this EO but will be addressed in the environmental document prepared for this study.

5.3 Cultural Resources/Section 4(f) Properties

Cultural resource data for the study area were primarily derived from the AZSITE online database. Supplemental data were obtained from site files at the Arizona State Museum and Arizona State University. This preliminary research offers an overview of previous cultural resource surveys and cultural resources documented as a result of those efforts.

The study area contains numerous cultural resources that are or may be eligible for inclusion in the National Register of Historic Places (NRHP) (Table 10). Alternatives B through H are understood to include new alignments plus those portions of the existing corridor (Alternative A) where they do not diverge from it. All alternatives exhibit fairly high archaeological site density. Alternatives B and C pass through the interior of the AFNM, which contains important historic and prehistoric archaeological resources east of I-17. Based on their proposed length, Alternatives G and H may affect the most number of cultural resources. In addition, Alternatives G and H have the greatest potential for visual impacts to the Old Black Canyon Road because of their proximity to this old stagecoach route on the west side of I-17. Additionally, preliminary background research indicates that all of the alternatives demonstrate potential 4(f) issues due the presence of two historic roads considered eligible for NRHP listing under Criterion A.

Table 10 – Survey Status, Number Of Sites, and Potential 4(f) Issues.

Alternative	% Surveyed*	Number of Known Properties Adjacent to or Near Alternative**	Potential 4(f) Issue
A	>75%	42	Three historic roads
B	0%	34	Two historic roads
C	<25%	35	Two historic roads
D	±50%	39	Three historic roads
E	<50%	38	Three historic roads
F	<25%	35	Three historic roads
G	<25%	16	Three historic roads
H	<25%	15	Three historic roads

* Percentages represent approximations; survey estimates for Alternatives B–H do not include portions of the existing alignment (Alternative A).

** For Alternatives B–H, the number includes properties located along the proposed alignment as well as properties along the portions of the existing alignment (Alternative A) north and/or south of the proposed alignment.

Additional cultural resources will likely be identified during the field surveys that will be conducted along the viable alternatives that will be analyzed in the project's environmental document. It is assumed that a Programmatic Agreement (PA) will be developed for compliance with Section 106 of the National Historic Preservation Act. The PA will stipulate measures required for continuing consideration of cultural resources, including inventory, eligibility, effect assessments, and appropriate mitigation of eligible resources that cannot be preserved. Such mitigation may include archaeological testing, monitoring, data recovery, or Historic American Building Survey/Historic American Engineering Record documentation.

5.4 Floodplains

A review of the Federal Emergency Management Agency Flood Insurance Rate Maps for the study area indicated I-17 is located adjacent to the 100-year floodplain of New River for several miles north of the New River TI located at MP 232.0. The existing freeway crosses the 100-year floodplain of the Agua Fria River at MP 243.6 and Big Bug Creek at MP 261.8. Floodplain impacts at these locations will be addressed as part of the detailed alternatives evaluation in the environmental document for this project.

5.5 Water Quality

A preliminary evaluation for the presence of potentially jurisdictional waters (as defined under the Clean Water Act of 1977 [33 US Code § 1251–1387]) was conducted in the study area through a review of U.S. Geological Survey topographical mapping. The existing I-17 corridor crosses at 30 "blue-line" drainages that typically exhibit the characteristics of jurisdictional waters of the U.S. (Waters), as regulated by the Corps of Engineers (Corps). A jurisdictional determination of WUS will need to be conducted in accordance with the Corps' June 2007 guidance along the most viable alternatives during the detailed environmental analysis and documentation for the project. In addition to Section 404 permits from the Corps, water quality certifications under Section 401 of the Clean Water Act and Arizona Pollutant Discharge Elimination System permits per Section 402(p) of the Clean Water Act will be required during final design from the Arizona Department of Environmental Quality.

5.6 Air Quality

The portion of the study area that extends from the New River TI (MP 232.0) to MP 241.6 lies within the Phoenix nonattainment area for eight-hour ozone. Otherwise, the project is in an area that complies with all other national ambient air quality standards. The applicability of the federal conformity procedures to this project will be addressed during the detailed environmental impact analysis of viable alternatives. The project will need to be included in the State Transportation Improvement Plan before the environmental document can be approved by the Federal Highway Administration.

This project is not anticipated to have an adverse effect on the air quality of the area. Some deterioration of air quality would be expected due to the operation of construction equipment and the slower traffic speeds through construction zones. However, this localized condition would be discontinued when the project is completed. Fugitive dust generated from construction activities would be controlled in accordance with the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104.08 (2000 Edition), special provisions, and local rules or ordinances.

5.7 Noise Impacts

Because this project would involve the construction of additional lanes along the I-17 corridor, the project will need to be evaluated in accordance with Federal Highway Administration requirements contained in 23 Code of Federal Regulations 772, Procedures for Abatement of Highway Traffic and Construction Noise and the Arizona Department of Transportation (ADOT) Noise Abatement Policy, December 5, 2005. The only potential sensitive receptor areas within the study limits are residential communities in Black Canyon City and at the northern end of the study area near Cordes Lakes. Therefore, a noise analysis would need to be conducted to determine the nature and extent of noise impacts in these areas. The findings of this analysis will be incorporated into the project's environmental document.

5.8 Hazardous Materials

A Preliminary Initial Site Assessment (PISA) has been conducted for the I-17 study corridor. The purpose of the PISA was to evaluate and identify the presence of hazardous materials or similar environmental concerns that might be affected by future improvement projects. This effort included on-site reconnaissance of the 30-mile corridor and associated parallel alternate study segments, as well as an evaluation of the regulatory database search report prepared by All Lands. To facilitate the characterization of the corridor, it was subdivided into three 10-mile sections, as described in the next sections.

5.8.1 I-17, MP 232.0 to MP 242.0

The southern end of the I-17 segment includes the New River TI and active and closed gasoline service stations, restaurants, and motels located outside the existing ADOT right-of-way (R/W). Some scattered private residences occur beyond the I-17 R/W corridor along with undeveloped natural desert with abundant natural saguaro cactus. There do not appear to be any areas of concern within this study segment.

5.8.2 I-17, MP 242.0 to MP 252.0

At MP 242.0, minor commercial development, a campground area, and scattered homes were noted within 1 mile east of I-17. Black Canyon City is located on both sides of I-17, where nearby frontage roads and streets had minor scattered refuse. The database search indicated there is one documented case of a leaking underground storage tank (LUST) at a gasoline station at I 17 and Squaw Valley Road, but it is located outside the existing ADOT R/W near MP 242.0. The records also indicated that a registered LUST for the Arizona Department of Public Safety at MP 242.0 had been removed in 1999. The Sunset Point Rest Area, which is located on the west side of I-17 approximately ½ mile south of the Sunset Point TI at MP 252.0, includes restroom facilities with septic systems. West–northwest of the rest area, several private agriculture-related structures and a large domestic water storage tank are present at the bottom of the valley. Because these noted facilities would likely be outside the proposed I-17 improvements, there do not appear to be any areas of concern within this study segment.

5.8.3 I-17, MP 252.0 to MP 262.0

The Badger Springs and Bloody Basin TIs are located between MP 252.0 and MP 262.0, but there are no services present at either location. East of the Badger Springs TI (MP 256.1), a 2 acre vacant, cleared dirt parking area is present along with an access road to the AFNM. Between MP 258.0 and MP 259.0, unpaved access roads parallel I-17 and the Bloody Basin Road TI to the east. At MP 262.0, the Cordes Junction TI includes fast-food restaurants, active Chevron and Shell gasoline service stations just beyond the ADOT R/W, and an ADOT maintenance yard in the northwest quadrant of the TI. The results of the site reconnaissance indicated that the potential for buried debris or structures, such as septic systems and other structures, could exist, particularly at abandoned properties where structures remain or were demolished. The study area contained minor scattered refuse. No other areas of hazardous materials or similar environmental concerns were identified during site reconnaissance. However, due to the large extent of this study area, the potential for undocumented or unidentified environmental concerns and hazardous materials areas exists.

This overview did not include any inspection or analysis of concrete materials for asbestos, lead paint, or related hazardous materials. These analyses will need to be conducted as part of the detailed environmental analysis of the most viable alternatives.

5.9 Socioeconomic Considerations

The study area has been evaluated with regard to Title VI of the Civil Rights Act of 1964, the Americans with Disabilities Act, and Executive Order 12898 on Environmental Justice. Residential or commercial development adjacent to the existing I-17 corridor is limited to the unincorporated communities of New River, located east of the New River TI (MP 232.0) in Maricopa County; and Rock Springs, southwest of the TI at MP 242.1; Black Canyon City, on both sides of I-17 between the TIs at MP 242.1 and 244.4; and Cordes Lakes, southeast of the Cordes Junction TI at MP 262.0—all of which are located in Yavapai County. The remainder of adjacent land is primarily administered by BLM.

As indicated in Table 11, the project vicinity has lower percentages of non-white residents than Maricopa County and the entire state but generally similar percentages to Yavapai County. The data in Table 12 indicate these percentages are generally the same among the communities along the study corridor. For persons of Hispanic origin, the project vicinity has a lower percentage than those for both counties and the state, while the community comparisons are fairly similar. Relative to persons over the age of 65, the project vicinity as a whole has a larger population than Maricopa County and less than Yavapai County, but the percentage for New River is substantially lower than those for Black Canyon City/Rock Springs and Cordes Lakes. Similarly, the percentage of the population that is either mobility limited or below the poverty level is much lower in New River than for the other communities to the north.

Although minorities are present in the study area, no distinct minority or low-income groups were identified in New River or Cordes Lakes because these communities are located approximately ¼ to ½ mile east of I-17. As a result, the proposed project would not have a disproportionately high and adverse human health or environmental effect on minority and low-income populations in these communities. The proximity of these populations relative to the Rock Springs and Black Canyon City communities will be determined during the evaluation of the viable alternatives. In general, the proposed project would benefit all residents of the area, as well as travelers through the area, in the form of improved roadway capacity and overall traffic operations.

Table 11 – 2000 Census Demographic Characteristics

Demographic Characteristics	Project Vicinity*	Maricopa County	Yavapai County	Arizona
Total population	15,495	3,072,149	167,517	5,130,632
Gender:				
Male	51.2%	50.0%	49.1%	49.9%
Female	48.8%	50.0%	50.9%	50.1%
Race:				
White alone	95.9%	77.4%	91.2%	75.5%
Black/African American alone	0.3%	3.7%	0.4%	3.1%
American Indian/Alaska Native alone	0.7%	1.8%	1.6%	5.0%
Asian alone	0.4%	2.2%	0.5%	1.8%
Native Hawaiian/Pacific Islander alone	0.07%	0.1%	0.1%	6,733
Some other race	1.1%	11.9%	3.6%	0.1%
Two or more races	1.4%	2.9%	1.9%	2.8%
Hispanic origin (any race)	4.8%	24.8%	9.8%	25.3%
Age 65 years and over	12.4%	11.4%	21.0%	12.8%
Mobility limitation	20.2%	16.4%	20.4%	17.6%
Below poverty level	8.6%	11.6%	11.7%	13.6%

* Includes data for New River, Black Canyon City/Rock Springs, and Cordes Lakes

Table 12 – 2000 Census Demographics in Project Vicinity

Demographic Characteristics	New River	Black Canyon City/Rock Springs	Cordes Lakes
Total population	10,740	2,697	2,058
Gender:			
Male	51.0%	52.3%	50.9%
Female	49.0%	47.7%	49.1%
Race:			
White alone	95.9%	95.8%	96.5%
Black or African American alone	0.4%	0.1%	0.1%
American Indian/Alaska Native alone	0.6%	1.2%	0.9%
Asian alone	0.5%	0.2%	0.1%
Native Hawaiian/Pacific Islander alone	0.05%	0.04%	0.2%
Some other race	1.2%	0.7%	0.7%
Two or more races	1.4%	1.8%	1.4%
Hispanic origin (any race)	4.9%	3.4%	6.2%
Age 65 years and over	7.3%	23.0%	25.2%
Mobility limitation	16.3%	25.0%	37.1%
Below poverty level	5.7%	12.9%	17.7%

5.10 Visual Resources

The I-17 study area is located inside the eastern boundary of BLM's AFNM/ Bradshaw-Harquahala Planning Area. The visual resources within this planning area have been classified in accordance with BLM's visual resource management (VRM) objectives (BLM Manual 8430), as described below.

VRM Class I Objective: To preserve the existing character of the existing landscape. The level of change to the characteristic landscape should be very low and must not attract attention; i.e., natural views are maintained.

VRM Class II Objective: To retain the existing character of the landscape. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features present; i.e., maintain visual landscapes in a natural appearance.

VRM Class III Objective: To partially retain the existing landscape character. Changes to the landscape should be moderate, not dominate the views of the area, and repeat the basic elements found in the predominant natural features of the landscape.

VRM Class IV Objective: To provide management activities that require major modifications to the existing landscape character. The level of change could be high and dominate view of the area, but the impacts should be minimized by limiting the disturbance and repeating basic elements.

Based on information obtained from BLM's Draft Resource Management Plan (October 2005) for this planning area, there are no Class I areas along the I-17 study corridor. Class II areas are located approximately from the Table Mesa TI to Moore Gulch and from the Black Canyon City TI to the Cordes Junction TI. Class III lands are located in the area from Moore Gulch to the Yavapai County line, while Class IV lands are located in the New River area east of I-17 and in the Rock Springs/Black Canyon City area.

The existing foreground, midground, and background viewsheds in the study area vary based on the terrain. The foreground and midground views in the undeveloped areas above and below Black Mesa are primarily of rolling terrain. The dominant background views are the Bradshaw Mountains west of I-17 and the New River Mountains east of I-17 south of the mesa. Black Mesa dominates background views for northbound motorists as they approach Black Canyon City. Midground views along the roadway are characterized by weathered cut slopes along the Black Canyon Hill section of I-17.

The visual impact assessment for the I-17 study will address the anticipated change to visual character associated with development of the viable alternatives. In addition, this assessment will need to address consistency with BLM's VRM objectives.

5.11 Recreational Resources

The BLM-managed land along the study corridor provides a variety of recreational opportunities. Typical activities within the AFNM include hiking, dispersed camping, visiting historic/cultural sites, nature study, and bird watching. Recreational uses on non-AFNM land include hunting, all-terrain vehicle use, camping, and picnicking in addition to the AFNM activities mentioned previously.

The recreational opportunities are addressed in BLM's land management goals and are based on three components: the activities, the setting, and the experience. Possible combinations of these components are defined by a system called the Recreation Opportunity Spectrum (ROS), which is divided into six classes: Primitive; Semi-Primitive Non-Motorized; Semi-Primitive Motorized; Roaded Natural; Rural; and Urban. These classes cover the full range of opportunities from wilderness experience to a substantially urbanized environment.

Within the study corridor, the area between New River and Black Canyon City has a ROS classification of Rural and is characterized by recreation sites that can be used by large numbers of people at one time. The recreational opportunities offered in this area are managed, regulated, and numerous but in harmony with nature. The area between Black Canyon City and Cordes Junction is classified as Semi-Primitive Motorized and provides opportunities for motorized recreation in a natural-appearing setting, where encounters with other users are generally low. The development and analysis of viable alternatives will need to address potential impacts to recreational uses, and access thereto, as well as consistency with the ROS classifications.

5.12 Wilderness Areas

There are no officially designated wilderness areas within the study limits. However, the northern portion of the AFNM immediately adjacent to I-17 and extending to the east exhibits wilderness characteristics, such as naturalness, outstanding opportunities for solitude, and/or primitive/unconfined recreational areas according to BLM's AFNM/Bradshaw-Harquahala Draft RMP. The development and analysis of alternatives in this area will need to account for these land characteristics.

6.0 Evaluation of Alternatives

6.1 Evaluation Criteria

Criteria were developed and used to evaluate the potential impacts of the I-17 alternatives. These criteria include:

- Traffic Operations
  - Length of Alternate Route
  - Incident Management
  - Flexible Capacity – Reversible Lane Connections
  - Connectivity to Existing Traffic Interchanges
- Right-of-way
  - Estimated Required
  - Potential Displacements
- Construction Impacts
  - Constructability
  - Earthwork, Major Structures & Pavement Cost Elements
- Roadway Geometry
  - Length of Grade Exceeding 5%
  - Maximum Grade
  - Design Speed
  - Number of Potential Major Structures
- Geotechnical
  - Slope Stability/Rock Fall Hazard
  - Potential for Large Scale Landslide Hazard
  - Presence of Problem Soils
  - Roadway Foundation Conditions
- Environmental & Aesthetics
  - Wildlife/Habitat
  - Threatened/Endangered/Sensitive Species Affected
  - Impacts to Agua Fria National Monument
  - Mining Claim Impacts
  - Visual Impacts
  - Cultural Resources
  - Water Quality
  - Noise Impacts
  - Hazardous Sites
  - Resource & Enhancement Opportunities
  - Consistency with BLM RMP
  - Change in Recreational Experience
- Public Involvement
  - Public Comment
- Other Areas of Concern
  - Impacts to Utilities
  - Maintenance of Facilities
  - Impacts to Drainage

6.2 Public Comments

The nine concept-level alternatives were presented to the public for comment in public meetings held January 23, 2007, in Black Canyon City, Arizona, and January 25, 2007, in Spring Valley, Arizona. Public comments included the following:

Comments Regarding Eastern Alternatives

- More preferable than Western Alternatives.
- Remove these from any further study. The high impacts to the AFNM are not acceptable.
- Not cost effective. Too far from I-17. Too much land to acquire. Impact too great to natural monument and wildlife. Need walls for noise from traffic in BCC.
- Both alternatives B and C are favorable because of the minimal impact on traffic.
- These alternatives impact the AFNM. The pronghorn antelope use Black Mesa and there are numerous archeological sites that would be impacted. The grade is too steep and I am wondering why these routes were even considered at all.
- Alternative B looks like too far to the east side and looks like too much steep roadway into the Black Mesa area.
- Alternative C is out because of excessive grades.
- Alternative B is the best.
- Neither alternative B nor C seems feasible. Both increase habitat fragmentation of Little Black Mesa for grassland species and both impact the AFNM. Steep grades are a major issue for truck traffic.

Comments Regarding Middle Alternatives

- Alternative D is my preference. It is the least destructive and the most acceptable. Please remove Alternative E from further study because of the high impact to recreational routes. Alternative A will not meet your project purpose due to steep grades.
- Alternative D is the most cost effective. Close to I-17. Best for law enforcement and emergency response as well as rerouting traffic during accidents. Would need sound protection walls in Black Canyon City for traffic. Most favorable route.
- Alternative E is the best overall compromise. Alternative D-1 (tunnel) is completely impractical and should be taken off the list.
- Alternative D still encroaches onto the antelope habitat on Black Mesa. Alternative E does not impact the AFNM. I suspect that these mining claims are not of a very big consequence, as is the impact to water catchments. The integrity of AFNM should be your highest priority.
- Too much impact during construction. I do not like the impact to the wildlife in E.
- I like the D and E alternatives with most existing interchanges, with minor impact to the wildlife.
- Option E is best because it stays close to the existing boundary leaves Maggie Mine and Crown King Roads alone.
- Alternative A is the best choice of these alternatives. However design in cross-overs for emergency routing of traffic, put routes as close to cliffs as possible. Move Sunset Point Rest Area. Use “Jersey” barriers to separate traffic at critical areas instead of median. Wildlife waters can easily be mitigated by moving or building new. Others (D, D-1, E) have significant problems.

Comments Regarding Western Alternatives

- Do not want any of these alternatives. It would destroy recreational use in this area. There is much less use on the east side of I-17.
- Go along the riverbed. I like this plan the best, Plan G.
- Not cost effective. Too much land acquirement. Not close to I-17. Not good for emergency response. Need noise walls for traffic in Black Canyon City.
- Alternatives F, G and H, are attractive for their minimal traffic disruption.
- I find alternative G to be the best alternative. Sunset Point Rest Area could be relocated off Black Mesa and with that happening the water from the rest area could be gotten from some source other than the Agua Fria River. Mining claims and water catchments are no a large concern. Black Mesa is free of impacts caused by car fires.
- H appears to be the only reasonable alternative.
- I like the G and H plans best. The traffic will increase every year from now on. A smaller rest area can be installed there in the near future.
- It would be great to encourage the truck traffic to mainly use the west route. That would ease the slow traffic up out of Black Canyon City to Sunset Point.
- A combination of F and G makes the most sense. I-17 becomes northbound or truck lanes on the east and cars on the west. G and H become southbound.
- I’d hate to see a highway through the Bumble Bee Valley. It’s a great natural art historic area and it does provide an alternative route in case of a highway shut down.
- G and H with expanding existing appear to be most sensible per terrain and impact.
- Alternatives G & H hold promise. Minimize footprint by use of “Jersey” barriers instead of divided lanes in critical areas. Maintain the old route for emergency routing only. Remove the fences from the old route. Wildlife waters can be easily moved, relocated, or replaced.

6.3 Evaluation Matrix

The matrix containing the criteria and the evaluation for each alternative appears in Table 13 on the following pages. This matrix is not intended to evaluate the alternatives against the No Build Alternative, but only to compare them with one another, since the No Build Alternative will be carried through the process regardless of the outcome of this preliminary evaluation.

The purpose of the preliminary evaluation of the alternatives is to determine which are viable for further consideration. At this level of the study, concept-level engineering design has been completed. However, the alternatives can be rated based on engineering judgment and a qualitative review of the impacts or user benefits associated with each alternative. Following this recommendation, more detailed engineering will be performed for the alternatives that are considered for further study.

Table 13 – Evaluation Matrix

I-17, Black Canyon City TI – Jct. SR 69: Evaluation Matrix									
	Corridor Alternative								
	Existing	East		Middle			West		
	A	B	C	D	D-1	E	F	G	H
Brief Description	Widen Existing Roadways (Inside, Outside, or Combination)	New Eastern Corridor Begins South of Black Canyon City TI and Ends South of Sunset Point TI	New Eastern Corridor Begins North of Black Canyon City TI and Ends South of Sunset Point TI	Generally Follows Existing Corridor In Median	Generally Follows Existing Corridor In Median – Tunnels	West of Existing Corridor on West Side of Canyon	New Western Corridor Beginning at Black Canyon City and Ending South of Sunset Point TI	New Western Corridor Beginning at Black Canyon City and Ending at Badger Springs Rd TI	New Western Corridor Beginning at Black Canyon City and Ending At Bloody Basin Rd TI
Traffic Operations									
Length of Alternate Route (Miles)	None	7.7	6.0	6.1	5.8	6.8	6.8	12.0	14.7
Opportunities for Traffic Crossover – Incident Management	Good	Poor	Poor	Good	Poor	Good	Poor - Good	Poor	Poor
Complexity of Reversible Lane Connections – Flexible Capacity	Less Complex	More Complex	More Complex	Less Complex	Less Complex	Less Complex	More Complex	More Complex	More Complex
Connectivity to Existing Traffic Interchanges	Connections provided to add existing TI's.	An easterly extension of Bumble Bee Rd would have profile grades of 7% and large fill slopes.	An easterly extension of Bumble Bee Rd would have profile grades of 7% and large fill slopes.	A connection to Bumble Bee Rd can be accommodated either in its existing location or slightly to the north.	A connection to Bumble Bee Rd can be accommodated either in its existing location or slightly to the north.	A flat portion of Bumble Bee Rd would be realigned to accommodate a connection.	A hilly portion of Bumble Bee Rd would be realigned to accommodate a connection. Profile grades would be near 7% maximum.	A hilly portion of Bumble Bee Rd would be realigned to accommodate a connection. Profile grades would be near 7% maximum. No access to Sunset Point rest area; however; there is potential for new connections to Bumble Bee Rd ~5 miles north of the existing TI.	A hilly portion of Bumble Bee Rd would be realigned to accommodate a connection. Profile grades would be near 7% maximum. No access to Sunset Point rest area; however; there is potential for new connections to Bumble Bee Rd ~5 miles north of the existing TI. No connection to Badger Springs Rd.
Right-of-Way									
Estimated Right-of-Way Required (Low - Med – High)	Low	High	Med - High	Low	Low	Med	Med - High	High	High
Potential Displacements	None	Approx. 50 single family residences, 6 apartments (in 3 bldgs), multiple outbuildings (garages, barns, sheds)	None	None	None	None	None	None	None
Construction									
Constructability (Accessibility, Terrain, Maintenance of Traffic)	Most Difficult; very disruptive to existing traffic	Less Difficult	Less Difficult	Difficult	Difficult	Difficult	Less Difficult	Less Difficult	Less Difficult

I-17, Black Canyon City TI – Jct. SR 69: Evaluation Matrix									
	Corridor Alternative								
	Existing	East		Middle			West		
	A	B	C	D	D-1	E	F	G	H
Earthwork, Major Structures, & Pavement Cost Elements (Low - Med – High)	Low	Med	Low	Med	High	Med	Med	Med	Med
Roadway Geometry									
Length of Grade Exceeding 5% (Miles) – (RDG Max Grade Mountainous Terrain)	NB – 2.8 SB – 4.0	0	2.3	0	0	0	1.2	0	0
Maximum Grade (Nearest %)	6	5	10	5	5	5	10	5	5
Design Speed – (mph) (Horizontal/Vertical)	65 (with superelev. imprvmts) / 55 (exst)	65 / 65	65 / 65	65 / 65	65 / 65	65 / 65	65 / 65	65 / 65	65 / 65
Number of Potential Structures Required – (fills > 100 ft) (Low - Med – High)	Widen existing bridges at TIs and Big Bug Ck (med)	1 structure (1300 ft) (med)	No large structures (low)	4 structures (5000 ft) (med)	1 structure (1000 ft) 2 tunnels (11900 ft) (high)	2 structures (2000 ft) (med)	4 structures (5600 ft) (med)	1 structure (600 ft) (med)	1 structure (600 ft) (med)
Geotechnical									
Slope Stability/Rockfall Hazard Level of Risk (low - moderate - high)	Significant cuts (hillside construction) will be required in the phyllites and basalts between approx MPs 245 and 250. High cut slopes will result in rockfall hazard. Retaining walls may be required for grade separations. Significant work will be required to design slopes and/or treatment options. (high)	Significant through cuts will be required in the sedimentary rocks and basalt in Sections 14, 23 and 26 of T9N, R2E (approx MP 245 to 247.5) as roadway elevation changes 1200 feet over a 2-mile distance. High cut slopes will result in rockfall hazard. Remainder of alignment is relatively flat. (moderate to high)	Significant through cuts will be required in sedimentary rocks and basalts in Sections 14 and 22 of T9N, R2E (approx MP 245.3 to 247.5) as roadway elevation changes 900 feet over a 2-mile distance. High cut slopes will result in rockfall hazards. Remainder of alignment is relatively flat. (moderate to high)	Rugged terrain in Sections 3, 10 and 15 of T9N, R2E (approx MP 246.7 to 250) will require numerous small cuts in phyllites and basalts. The phyllites are prone to wedge and planar failures. Significant work will be required to design slopes and/or treatment options in hillside cuts. (high)	Slope stability/ rockfall hazard for road cuts similar to Alternative D. Tunneling conditions generally are unfavorable based on projected joint orientations in phyllites and possible presence of unconsolidated Tertiary sediments along upper tunnel alignment (high)	Rugged terrain and hillside cuts in Sections 3, 10 and 16 of T9N,R2E and Section 33 of T9.5N, R2E (approx MP 246.7 to 250.8) will require numerous small cuts in phyllites which are prone to wedge and planar failures. Significant work will be required to design slopes and/or treatment options. (high)	Rugged terrain in Sections 4, 9 and 16 of T9N, R2E and Section 34 of T9.5N, R2E (approx MP 246.7 to 250.8) will require cuts in phyllites which are prone to wedge and planar failures. Significant work will be required to design slopes and/or treatment options. (moderate to high)	Numerous cuts will be required in the phyllites exposed along much of the alignment. The phyllites are prone to wedge and planar failures. Significant work will be required to design slopes and/or treatment options. (moderate to high)	Numerous cuts will be required in the phyllites exposed along much of the alignment. The phyllites are prone to wedge failures. Significant work will be required to design slopes and/or treatment options. (moderate to high)
Potential for Large-scale Landslide Hazard (low - moderate - high)	Existing landslide deposits occur near southern portion of alignment. Associated with basalt overlying sedimentary rocks. (moderate)	Existing landslide deposits occur near southern portion of alignment. Associated with basalt overlying sedimentary rocks. (moderate)	Existing landslide deposits occur near southern portion of alignment. Associated with basalt overlying sedimentary rocks. (moderate)	(low to moderate)	(low to moderate)	(low to moderate)	(low to moderate)	(low to moderate)	(low to moderate)
Presence of Problem Soils (low - moderate - high)	Potential for expansive soils in basalt and in the sedimentary rocks in southern portion of alignment (lakebed deposits) (moderate)	Potential for expansive soils in basalt and in the sedimentary rocks in southern portion of alignment (lakebed deposits). (moderate)	Potential for expansive soils in basalt and in sedimentary rocks in southern portion of alignment (lakebed deposits). (moderate)	(low)	(low)	(low)	(low)	(low)	(low)

I-17, Black Canyon City TI – Jct. SR 69: Evaluation Matrix									
	Corridor Alternative								
	Existing	East		Middle			West		
	A	B	C	D	D-1	E	F	G	H
Roadway Foundation Conditions (poor - fair - good)	(poor to fair)	(poor to fair)	(poor to fair)	(good)	(good)	(good)	(good)	(good)	(good)
Environmental & Aesthetics									
Land Use Impacts	Minimal to no impact, depending on widening location	High impact – AFNM; 2 BLM grazing allotment; residential community in NW Black Canyon City	High impact – AFNM and 2 BLM grazing allotments	Minimal to no impact due to median location	Minimal to no impact due to median location	From south to north, impacts vary from moderate to low to high based on proximity to I-17	From south to north, impacts vary from moderate to low to high based on proximity to I-17	From south to north, impacts vary from high to low based on proximity to I-17; 4 BLM grazing allotments affected, including the economic viability of 2 allotments	From south to north, impacts vary from moderate to high; 4 BLM grazing allotment affected, including the economic viability of 2 allotments
Mining Claim Impacts	4 mining claims along existing I-17 corridor	No impact – no mining claims along projected route	1 mining claim – located at divergence from A	4 mining claims - all bisected by the existing I-17 corridor (A)	4 mining claims - all bisected by the existing I-17 corridor (A)	3 claims bisected by existing I-17 corridor (A) 4 additional claims north of divergence from A	4 claims bisected by existing I-17 corridor (A) 13 additional claims north of divergence from A	3 claims bisected by existing I-17 corridor (A) 14 additional claims north of divergence from A	3 claims bisected by existing I-17 corridor (A) 18 additional claims north of divergence from A
Wildlife/Habitat • Travel Corridors Crossed (#) • Effect on Corridor Function • Riparian habitat • Water catchments	• 15 existing crossings • Low effect • Minimal effect • No effect	• 2 new crossings • High effect: fragments pronghorn habitat & fawning areas • Major drainages crossed – potential riparian impacts • No effect	• 2 new crossings • High effect: fragments pronghorn habitat & fawning areas • Major drainages crossed – potential riparian impacts • No effect	• 2 new crossings • Moderate effect • Minimal effect • No effect	• 2 new crossings • Low effect • Minimal effect • No effect	• 4 new crossings • Moderate effect • High impact potential • Potentially displaces an AGFD catchment	• 5 new crossings • Moderate effect • Moderate impact potential • No effect	• 9 new crossings • High effect: AGFD water catchment eliminated • High impact potential • Potentially displaces an AGFD catchment	• 11 new crossings • High effect: AGFD water catchment access affected • High impact potential • No effect
Threatened/Endangered/Sensitive Species Affected • Animal • Plant • Wildlife species of concern (WSC)	T&E: 3 fish, 2 birds; BLM Sensitive: 2 fish, 1 plant, 1 insect; 8 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 plant, 1 insect ; 7 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish, 1 bird; BLM Sensitive: 2 fish, 1 insect; 7 WSC	T&E: 3 fish, 1 bird; BLM Sensitive: 2 fish, 1 insect; 7 WSC
Impacts to Agua Fria National Monument (AFNM)	Possible impacts associated with NB lane widening	Direct impacts	Direct impacts	No impact due to median location	No impact due to median location	None; corridor outside AFNM	None; corridor outside AFNM	None; corridor outside AFNM	None; corridor outside AFNM
Visual Impacts Evaluation based upon the applicable VQO and BLM's preferred alternative in its draft RMP/EIS.	Class III (partial retention) allows some minor changes in the visual landscape; low to moderate impacts likely	Class II (retention): changes should not be evident and should "mirror" line, form, color, etc. of existing visual landscape; high impact likely	Class II(retention): changes should not be evident and should "mirror" line, form, color, etc. of existing visual landscape; high impact likely	Class III (partial retention): minor changes are okay; moderate impacts likely due to new alignment between existing roadways	Class III (partial retention): minor changes are okay; moderate impacts likely due to new tunnel openings	Mostly Class III (partial retention); Class II (retention) at northern end; moderate to high impacts likely	Mostly Class II (retention); moderate impacts in rolling terrain but high impact in steeper terrain	Class II (retention): moderate impacts in rolling terrain but high impact in steeper terrain	Class II (retention): moderate impacts in rolling terrain but high impact in steeper terrain

I-17, Black Canyon City TI – Jct. SR 69: Evaluation Matrix									
	Corridor Alternative								
	Existing	East		Middle			West		
	A	B	C	D	D-1	E	F	G	H
Cultural Resources Alternatives A-H are understood to include new alignments plus those portions of the existing corridor (A) where they do not diverge from it. For this reason, ALL alternatives have 3 possible red flags. All can be expected to exhibit fairly high site density; thus there is no solid basis to distinguish among them. BLM surmises that B and C will have the highest impacts to cultural resources because they pass through the AFNM. Alts. G and H are also expected to have high density due to the potential for sites along Bumble Bee Creek and in Alkali Canyon.	Majority surveyed; 33 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads)	Unsurveyed away from A; 14 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads). High site density expected as it traverses the AFNM.	Largely unsurveyed away from A; 14 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads). High site density expected as it traverses the AFNM.	Roughly ½ unsurveyed away from A; 15 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads)	Roughly ½ unsurveyed away from A; 15 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads)	Less than ½ unsurveyed away from A; 15 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads)	Less than ½ unsurveyed away from A; 14 known properties (most require data recovery or avoidance); 3 possible red flags (historic roads) and potential for impacts to portions of historic Black Canyon Highway.	Largely unsurveyed away from A; 13 known properties (most require data recovery or avoidance) also high site density likely because it passes through Alkali Canyon; 3 possible red flags (historic roads) and high potential for visual impacts to pristine portions of Old Black Canyon Road	Largely unsurveyed away from A; 13 known properties (most require data recovery or avoidance) also high site density likely as it follows Bumble Bee Creek; 3 possible red flags (historic roads) and high potential for visual impacts to pristine portions of Old Black Canyon Road
Water Quality • Stream Crossings (#) - Existing - New • Proximity to Streams • Floodplain Impacts	13 stream crossings including Agua Fria River and Big Bug Creek; Agua Fria River and Big Bug Creek are within a 100-yr floodplain	6 new crossings; no floodplain impacts	3 new crossings; no floodplain impacts	6 new crossings; no floodplain impacts	6 new crossings; no floodplain impacts	3 new crossings; no floodplain impacts	4 new crossings; no floodplain impacts	11 new crossings, including Bumble Bee Creek; Bumble Bee Creek is within a 100-yr floodplain	24 new crossings, including Black Canyon Creek, Bumble Bee Creek and Government Springs Wash; Black Canyon Creek and Bumble Bee Creek are within a 100-yr floodplain
Noise Receptors Present	A few receptors near MP 244	Additional impacts may occur east of alignment near MP 244	None	None	None	None	None	None	None
Hazardous Material Sites (All Lands Title records search only)	4 prior HazMat incidents occurred along I-17 from MP 244 to MP 260; no existing issues. low risk	No record of occurrences on undeveloped BLM land. negligible risk	No record of occurrences on undeveloped BLM land. negligible risk	1 prior HazMat incident occurred Bumble Bee NB exit ramp, however no existing issues remain. low risk	1 prior HazMat incident occurred Bumble Bee NB exit ramp, however no existing issues remain. low risk	No record of prior incidents. negligible risk	No record of prior incidents on undeveloped BLM land. negligible risk	No record of prior incidents on undeveloped BLM land. negligible risk	No record of prior incidents on undeveloped BLM land. negligible risk
Resource & Enhancement Opportunities	Revegetation of disturbed areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas	Revegetation of disturbed areas; Enhancement of riparian areas
Consistency with BLM RMP (Preferred RMP Alternative)	Consistent	Not consistent	Not consistent	Not consistent	Not consistent	Not consistent	Not consistent	Not consistent	Not consistent
Change in Recreational Experience	No change anticipated	Limited access highway could sever existing trails	Limited access highway could sever existing trails	No change anticipated	No change anticipated	Limited access highway could sever existing trails; hunter access along Bumble Bee Rd. adversely affected	Limited access highway could sever existing trails; hunter access along Bumble Bee Rd. adversely affected	Limited access highway could sever existing trails; hunter access along Bumble Bee Rd. adversely affected	Hunter access along Bumble Bee Rd. adversely affected
Other Areas of Concern									
Impacts to Utilities (Low – Medium – High)	Low	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium - High
Maintenance of Facilities (Low – Medium – High)	Low	Medium	Medium	Medium	Low	Medium	Medium	Medium	Medium
Impacts to Drainage (Low – Medium – High)	Low	Medium	Medium	Medium	Low	Medium	Medium	Medium - High	Medium – High

7.0 Recommendations

7.1 No-Build Corridor Alternative

The No-Build Corridor Alternative is provided for comparison purposes. There is no design or construction associated with the No-Build Corridor Alternative. In addition, there is no expenditure of funds and no obvious change to the environmental features that exist within the study limits of Interstate 17. However, the No-Build Corridor Alternative:

- Would require continuing expenditures to rehabilitate and maintain an aging roadway and series of bridges
- Would not achieve the goal to improve the capacity and traffic operational characteristics of the route between Phoenix and northern Arizona
- Would experience negative changes to the air quality as traffic volumes increase

The No-Build Corridor Alternative will be carried forward for further study.

7.2 Build Corridor Alternatives

The nine Build corridor alternatives are summarized by listing their respective pros and cons. Four of the nine Build alternatives are recommended for further more detailed study. Three of these alternatives are Alternatives D, E and H. Alternative A will be considered in combination with these three alternative alignments; however, Alternative A by itself is not a feasible solution because of constructability issues. The alternative alignments recommended for further study are shown on Figure 8.

Alternative A – Widen Existing Roadways (Inside, Outside, or Combination)

Pros	Cons
• Low right-of-way requirements • No displacements of residences or businesses • Relatively low earthwork requirements • Minimal to no impacts to land use depending on widening location • Maintain the existing number of wildlife/habitat travel corridor crossings (15) • Low effect on wildlife travel corridor functionality • Minimal effect on riparian habitat • Low impact to wildlife • Low to moderate visual impacts • Consistent with BLM Resource Management Plan • Maintain connectivity to existing traffic interchanges • No change in recreational experience • Low impacts to existing utilities • Low risk of hazardous material sites	• No alternate route provided • Construction would be very disruptive to existing I-17 traffic • Construction duration would be lengthy due to heavy existing traffic and no alternate route • Blasting and rock fall mitigation in close proximity to existing I-17 would require complete closures of both lanes in one direction • Grades exceed maximum 5% in mountainous terrain (MP 244.5-250.5) and 4% in rolling terrain (MP 250.5-262.0) • High risk of slope stability and rock fall hazards with high slopes • Moderate potential for expansive soils in southern portion of alignment • Poor to fair roadway foundation conditions • Possible impacts to AFNM associated with NB lane widening • 4 mining claims affected

Conclusion: Alternative A is not recommended for further study; however, Alternative A in combination with the remaining alternatives will be considered for further study.

Alternative B – New Eastern Corridor Begins South of Black Canyon City TI and Ends South of Sunset Point TI

Pros	Cons
• 7.7 miles of alternate route provided • Constructability would be less difficult • Would provide grade of 5% or flatter in mountainous terrain (MP 244.5-250.5) and 4% or flatter in rolling terrain (MP 250.5-262.0) • Only 2 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Negligible risk of hazardous material sites • Maintain connectivity to existing traffic interchanges – one new connector road would be required • Low impacts to existing utilities • No mining claims affected	• High right-of-way requirements • Displacement of approximately 50 single family residences, 6 apartment buildings and other outbuildings • High earthwork requirements • Moderate to high risk of slope stability and rock fall hazards with high slopes • Moderate potential for expansive soils in southern portion of alignment • Poor to fair roadway foundation conditions • High impact to 2 grazing allotments • Fragments pronghorn habitat & fawning areas • Potential impacts to riparian habitat – major drainages crossed • High impact probability to wildlife • Direct impacts to Agua Fria National Monument • High impacts to AFNM cultural resources • High visual impacts likely • 6 new stream crossings • Potential noise impacts to Black Canyon City • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails • Potential encroachment to floodplain • Low public and agency support

Conclusion: Alternative B is not recommended for further study.

Alternative C – New Eastern Corridor Begins North of Black Canyon City TI and Ends South of Sunset Point TI

Pros	Cons
• 6.0 miles of alternate route provided • Constructability would be less difficult • No displacements of residences • Earthwork would be relatively low compared to other corridor alternatives • Only 2 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Negligible risk of hazardous material sites • Maintain connectivity to existing traffic interchanges – one new connector road would be required • Low impacts to existing utilities	• 10% maximum grade – exceeds maximum 5% in mountainous terrain (MP 244.5-250.5) • High right-of-way requirements • Moderate to high risk of rock fall hazards with high slopes • Moderate potential for expansive soils in southern portion of alignment • Poor to fair roadway foundation conditions • High impact to 2 grazing allotments • High effect on wildlife travel corridor functionality – fragments pronghorn habitat & fawning areas • Potential impacts to riparian habitat – major drainages crossed • High potential impact to wildlife • Direct impacts to Agua Fria National Monument • High impacts to AFNM cultural resources • High visual impacts likely • 3 new stream crossings • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails • 1 mining claim affected • Low public and agency support

Conclusion: Alternative C is not recommended for further study.

Alternative D – Generally Follows Existing Corridor In Median

Pros	Cons
• 6.1 miles of alternate route provided • Low right-of-way requirements • No displacements of residences or businesses • Would provide a grade of 5% or flatter in mountainous terrain (MP 244.5-250.5) • Good roadway foundation conditions • Minimal to no impacts to land use due to median location • Only 2 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Moderate effect on wildlife travel corridor functionality • Minimal effect on riparian habitat • Moderate impacts to wildlife • No impacts to AFNM due to median location • Low risk of hazardous material sites • Moderate visual impacts • Maintain connectivity to existing Bumble Bee Traffic Interchange – at existing location or new location slightly to the north • No change in recreational experience	• Construction could be disruptive to existing I-17 traffic • Blasting and rock fall mitigation in close proximity to existing I-17 would likely require complete closures of both lanes in one direction • High risk of slope stability and rock fall hazards with high slopes • 6 new stream crossings • Medium impacts to existing utilities • 4 mining claims affected

Conclusion: Alternative D is recommended for further study.

Alternative D-1– Generally Follows Existing Corridor In Median – Tunnels

Pros	Cons
• 5.8 miles of alternate route provided • Low right-of-way requirements • No displacements of residences or businesses • Would provide a grade of 5% or flatter in mountainous terrain (MP 244.5-250.5) • Minimal to no impacts to land use due to median location • Only 2 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Low effect on wildlife travel corridor functionality • Minimal effect on riparian habitat • Moderate impacts to wildlife • No impacts to AFNM • Moderate visual impacts – due to new tunnel openings • Low risk of hazardous material sites • Maintain connectivity to existing Bumble Bee Traffic Interchange – at existing location or new location slightly to the north • No change in recreational experience	• Soil conditions generally unfavorable for tunneling – high risk of slope stability and rock fall hazards • Construction could be disruptive to existing I-17 traffic • Tunnel costs prohibitively high • Blasting and rock fall mitigation in close proximity to existing I-17 could require complete closures of both lanes in one direction • Constructability would be difficult and may be disruptive to existing I-17 traffic • High risk of slope stability and rock fall hazards with high slopes • Need to retain existing roadway for vehicles carrying hazardous cargo • Earthwork would be the most complex due to tunneling • 6 new stream crossings • Medium impacts to existing utilities • 4 mining claims affected

Conclusion: Alternative D-1 is not recommended for further study.

Alternative E – West of Existing Corridor on West Side of Canyon

Pros	Cons
• 6.8 miles of alternate route provided • No displacements of residences or businesses • Would provide a grade of 5% or flatter in mountainous terrain (MP 244.5-250.5) • Low presence of problem soils • Good roadway foundation conditions • Moderate effect on wildlife travel corridor functionality • Moderate impacts to wildlife • No impacts to Agua Fria National Monument • Negligible risk of hazardous material sites • Maintain connectivity to existing Bumble Bee Traffic Interchange	• Moderate right-of-way requirements • Construction could be disruptive to existing I-17 traffic • Blasting and rock fall mitigation in close proximity of existing I-17 could require complete closures of both lanes in one direction • Substantial earthwork required • High risk of slope stability and rock fall hazards with high slopes • 4 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Moderate effect on riparian habitat • Moderate to high visual impacts • 3 new stream crossings • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails and hunter access • Medium impacts to existing utilities • Potential impacts to wildlife water catchment • 7 mining claims affected

Conclusion: Alternative E is recommended for further study.

Alternative F – New Western Corridor Beginning at Black Canyon City and Ending South of Sunset Point TI

Pros	Cons
• 6.8 miles of alternate route provided • Constructability would be less difficult; low impacts to existing traffic flow • No displacements of residences or businesses • Low potential for expansive soils • Good roadway foundation conditions • Moderate effect on wildlife travel corridor functionality • Moderate potential impacts to riparian habitat • No impacts to Agua Fria National Monument • Negligible risk of hazardous material sites • Maintain connectivity to existing traffic interchanges – new connector road would be required	• Medium to high right-of-way requirements • 10% grade for 1.2 miles – exceeds the maximum 5% in mountainous terrain (MP 244.5-250.5) • Substantial earthwork required • Moderate to high risk of slope stability and rock fall hazards • 5 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • High impact probability to wildlife • Moderate to high visual impacts likely • 4 new stream crossings • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails • Medium to high impacts to existing utilities • 17 mining claims affected

Conclusion: Alternative F is not recommended for further study.

Alternative G – New Western Corridor Beginning at Black Canyon City and Ending at Badger Springs Rd TI

Pros	Cons
• 12.0 miles of alternate route would be provided • Constructability would be less difficult; low impacts to existing traffic flow • No displacements of residences or businesses • Would provide a grade of 5% in mountainous terrain and 4% in rolling terrain • Low potential for expansive soils • Good roadway foundation conditions • No impacts to Agua Fria National Monument • Negligible risk of hazardous material sites	• High right-of-way requirements • High earthwork requirements • Impacts to 4 BLM grazing allotments • 9 additional new travel corridor crossings to the existing number (15) of wildlife/habitat travel corridor crossings • Potential impacts to wildlife water catchment • High potential impacts to riparian habitat • High impact probability to wildlife • Moderate to high visual impacts likely • 11 new stream crossings • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails • Medium to high impacts to existing utilities • New connector road would be required for Bumble Bee Traffic Interchange • Potential impacts to Sunset Point Traffic Interchange and rest area access • Potential encroachments to floodplains • 17 mining claims affected • Difficult connection to I-17 north because of terrain

Conclusion: Alternative G is not recommended for further study.

Alternative H – New Western Corridor Beginning at Black Canyon City and Ending At Bloody Basin Rd TI

Pros	Cons
• 14.7 miles of alternate route provided • Constructability would be less difficult; low impact to existing traffic flow • No displacements of residences or businesses • Would provide a grade of 5% or flatter in mountainous terrain and 4% or flatter in rolling terrain • Low potential for expansive soils • Good roadway foundation conditions • No impacts to Agua Fria National Monument • Negligible risk of hazardous material sites • High public support	• High right-of-way requirements • High earthwork requirements • Impacts to 4 BLM grazing allotments • 11 additional new travel corridor crossings to the existing number (15) of wildlife/ habitat travel corridor crossings • High potential impacts to riparian habitat • High impact probability to wildlife • Moderate to high visual impacts likely • 24 new stream crossings • Not consistent with BLM Resource Management Plan • Impacts to recreational experience – limited access, sever existing trails • Medium to high impacts to existing utilities • New connector road would be required for Bumble Bee Traffic Interchange • Potential impacts to Sunset Point Traffic Interchange and rest area access • Potential impacts to Badger Springs Traffic Interchange and AFNM access • Require several bridge structures to cross Bumble Bee Creek and Governors Spring Wash • Potential impact to floodplain along Bumble Bee Creek • Bank protection anticipated due to the alignment's proximity to Bumble Bee Creek for several miles • 21 mining claims affected

Conclusion: Alternative H is recommended for further study.

7.3 Conclusions

In addition to the No Build alternative, a total of nine alignment alternatives have been developed to add capacity and improve operations of I-17. Alternative A would widen and improve the existing northbound and southbound roadways on the existing alignments. Alternatives B and C would realign the highway to the east of existing I-17. Alternatives D, D-1, and E would realign the highway near the existing highway. Alternatives F, G, and H realign the highway in corridors west of existing I-17.

The No Build Alternative, as well as Alternatives D, E, and H, are recommended for further study in the Design Concept Report and environmental studies. The Build alternatives will also be considered in combination with widening the existing northbound and southbound roadways (Alternative A). Some of the advantages of these alternatives over those recommended for elimination include the following:

- Provides maximum length of alternate route (H)
- Low right-of-way requirements (D)
- Few new wildlife crossings (D)
- No impacts to Agua Fria National Monument (D, E, H)

Alternative H is similar to Alternative G for much of its length; however, H provides a greater length of alternate route and has more favorable terrain for connecting to existing I-17 at its north end.

It is recommended that Alternatives B, C, D-1, F, and G be eliminated from further consideration for the following reasons:

- Impacts to Agua Fria National Monument (B, C)
- Lack of public and agency support (B, C, D-1, F, G)
- Potential impacts to wildlife water catchment (G)
- Impacts to Alkali Canyon, cultural resources (G)
- Poor geotechnical conditions (D-1)
- Impacts to residences in Black Canyon City (B)
- Roadway geometry / steep grades don't meet current design criteria (C, F)

The study team initially recommended Alternative G over Alternative H at the January 2007 public meetings. However, the greater length of alternative alignment provided by Alternative H was supported by the public and by stakeholder agencies.

Following acceptance of the alignment alternatives presented in this report, a design concept study and environmental studies will be conducted to determine a recommended roadway solution and to define an implementation plan.

FIGURE 8 – RECOMMENDED ALTERNATIVE ALIGNMENTS FOR FURTHER STUDY